REPORTS

FROM

COMMISSIONERS, INSPECTORS,

AND OTHERS:

THIRTY-FIVE VOLUMES.

—(9.)—

MINES; COAL DUST IN MINES.

Session

12 *March* 1894 —— 25 *August* 1894.

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1894.

REPORTS

FROM

COMMISSIONERS, INSPECTORS,

AND OTHERS:

1894.

THIRTY-FIVE VOLUMES:—CONTENTS OF THE

NINTH VOLUME.

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MINES.

REPORT

OF

W. BEATTIE SCOTT, Esq., H.M. INSPECTOR OF MINES

FOR THE

SOUTH STAFFORDSHIRE DISTRICT (No. 11),

TO

HER MAJESTY'S SECRETARY OF STATE,

UNDER

The Coal Mines Regulation Act, 1887, the Metalliferous Mines Regulation Acts, 1872 and 1875, and the Slate Mines (Gunpowder) Act, 1882;

For the Year 1893.

Presented to both Houses of Parliament by Command of Her Majesty.

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1894.

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Mr. W. Beattie Scott's Report.

REPORT upon the INSPECTION of MINES in the SOUTH STAFFORDSHIRE DISTRICT, for the Year ended the 31st December 1893.—By W. BEATTIE SCOTT.

Great Barr, Birmingham,
8th March 1894.

SIR,

I HAVE the honour to submit to you my annual report upon my proceedings during the year 1893 as the Inspector of Mines in charge of the South Staffordshire Mining District, under Section 43 of the Coal Mines Regulation Act, 1887, and Section 20 of the Metalliferous Mines Regulation Act, 1872.

This district remains unchanged in extent, being as to boundaries as described in my last annual report. It comprises mines of coal, ironstone, and fireclay under the first-mentioned Act, and mines of Silurian limestone, chalk, and flint under the last-named Act. Salt brine is pumped in and near Droitwich in the county of Worcester, and phosphates of lime are quarried in the county of Suffolk.

General review.

The history of the year under review presents very few satisfactory features. Although the persons employed remain nearly the same as those engaged in the previous year, yet the output of minerals has considerably decreased and the number of fatalities has increased.

The cause of the increase in the death-rate is partly due to three accidents which produced more than one death each, but when it is considered, as will hereafter be pointed out, that a large portion of the district was idle for about four months, and in consequence a decrease in the death-rate might have been looked for, this explanation does not furnish any satisfactory features. The increase may only be due to the usual annual fluctuation, but as the total approaches very nearly to the decennial average, this idea does not hold out much prospect of improvement and gives rise to the thought that the death-rate, allowing for the usual ebb and flow, has reached the lowest point where our present knowledge can lead us.

Output of minerals.

The output of minerals which were raised under the Coal Mines Regulation Act, as compared with the year 1892, was as follows :—

Minerals.	1893.	1892.
	Tons.	Tons.
Coal - - - -	8,970,820	9,995,691
Ironstone - - -	51,572	64,137
Fireclay - - -	294,342	320,248
Pyrites, &c. - -	1,707	1,290
	9,318,441	10,381,366
Decrease - -	1,062,925	

This is a serious decrease for one year and for a small district, but if a glance backwards is taken, it will be seen that with regard to output the year 1886 was worse, for the total of minerals raised in that year was only 8,987,545 tons.

The coal strike.

The cause of this decrease for the year under review is easily explained. A prolonged strike of the workpeople against a proposed reduction in wages accounts very nearly for the whole reduction. It is true that the warm character of the temperature of the early spring and summer of the past year reduced the demand for house coal, so much so that collieries upon Cannock Chase, which rely largely upon the household demand for their harvest, were only able to work, just before the strike, $1\frac{3}{4}$ to 2 days per week.

The cessation of work began on the 29th July, and the men returned to work on the 20th November.

The strike affected for about three weeks nearly all the collieries to the north of the Bentley fault or the town of Walsall, and for the whole of the above-named period nine of the largest collieries upon Cannock Chase. The decrease in the output of all the collieries comprised within that area was for the year 1,237,222 tons. The loss of the owners in profit and in wages of the workmen upon this decrease of output must have amounted to a considerable sum.

The output of ironstone, at the present annual rate of decrease, will soon cease. In the year 1877 the quantity raised was 206,452 tons, whilst last year it was only 51,572 tons.

The output of fireclay shows a decrease also, it having been 294,342 tons as against 320,248 tons in the preceding year.

Persons employed.

The number of persons employed during the year was returned as 27,484. This, at a first glance, appears to be an increase upon the numbers of the previous year of about 1,000 persons, but as in the totals of the persons employed during 1893 *above ground* have been included those employed on private branch railways, which before have been shown in another separate table, these figures are not really an increase, but nearly the same as those returned as employed *above ground* during 1892.

Number of mines.

318 mines of all the classes included under the Act, except mines of shale, which do not exist here, were at work during the year, and mineral was raised during 57,714 days, or again, an average of 182 days per annum. What might not the output be if trade was prosperous enough to enable all the mines to raise mineral for 11 days per fortnight during the whole year?

Prices of minerals.

The average prices of the minerals for the year were—

	s.	*d.*	
Coal - - - - - -	7	5	per ton.
Ironstone - - - - - -	12	0	,,
Fireclay - - - - -	5	0	,,

The price of coal at the pits' mouth in the county of Worcester is about 1*s.* per ton lower than in Staffordshire. There is a considerable difference between the quality of the coals on the northern and southern boundaries of the coalfield.

Table of accidents.

The cost for the year under review of raising the above-mentioned quantity of minerals, as measured by the loss of life and injury to the workmen, was 41 deaths through 37 separate accidents, and 259 injuries. A table of these accidents under the principal heads is given below:—

1893.	Deaths.	Injuries.
Explosions of fire-damp - -	3	21
Falls - - - -	14	105
Shafts - - -	8	14
Miscellaneous - - -	13	99
On surface - - - -	3	20
Totals - -	41	259
Totals in 1892 - - -	36	274

These figures, of course, convey no idea to the mind of anyone as to their comparative value, therefore the decennial average of fatalities is given below under the same classification.

Explosions of fire-damp - - -	3·5	deaths.
Falls - - - - - -	20·6	,,
In shafts - - - - -	4·4	,,
Miscellaneous - - - - -	19·3	,,
On surface - - - - -	3·8	,,
Ten years' average -	42·6	,,

Now the figure of total deaths, that is 41, does not compare so favourably as it otherwise would with this decennial average of 42·6, because for the first time in the history of mining statistics have fatalities on private branch railways and tramways been included under the head of mining accidents.

The injuries, as well as the deaths, show a sensible reduction in number, as they have come down from 298 in 1891 to 259 in 1893. This fact is distinctly gratifying and helps to point out the gradual improvement which is taking place.

If these figures are reduced to a percentage calculation upon the total fatalities which happened throughout the United Kingdom during the year 1892, no later figures being available at the time of writing, the present status of the district compares favourably, for it employed during that year 3·98 per cent. of the total persons employed, and lost by fatal accident 3·66 per cent. of the total deaths. This is not so good as the results in percentages shown by one or two other coalfields, but it is by no means the worst.

The injuries as well as deaths point to the most prolific causes of accidents, namely, falls and miscellaneous casualties underground, there having been during the year 105 injuries from falls and 99 miscellaneous injuries. Of the former a great many occur, in spite of every reasonable precaution having been taken, by timber giving way under roof pressure or from false bedding in the roof and sides, and only constant and incessant inspection and testing can prevent some of them. Again there were nine injuries from the careless handling of gunpowder, and 44 injuries from trams and tubs, which are largely due to the reckless contempt of danger shown by the young persons who are most concerned in the movement of trams and tubs. It is only by the constant ceaseless supervision of the officials that this class of accident can be reduced in numbers.

What shall be said of 20 injuries from so-called explosions of fire-damp, which, in reality, were only ignitions of the gas without any explosive force? It cannot be said, in this district, that familiarity breeds contempt, for perhaps its rarity is the cause of the injuries.

Of the three deaths caused by explosions of fire-damp, only one can be called accidental, the other two deaths from one accident being caused by a neglect of the Special Rule which enjoins a careful examination of each working place before a workman enters therein, although the inspection under General Rule 4 may have only just taken place.

The deaths in shafts have again exceeded the average. Three deaths in one accident at the Woodside Colliery when ascending were caused by the neglect of a night banksman of so gross a character that it approached perilously near the crime of manslaughter. Two other deaths by one shaft accident will never be explained, as the men were missed from the mouth of the shaft where they were working, and were found dead at the bottom of it with a tub of bricks, which appeared to have fallen down the shaft with them.

Four deaths were brought about by the careless use of blasting powder, when charging the shot holes, or by neglecting to give warning to everyone who might approach the site of an exploding charge.

Six deaths were caused by trams and tubs, as the little waggons used underground for conveying the mineral are called. An investigation into the causes of these fatalities justifies me in saying that each unfortunate person brought about his own death. As I have already remarked in commenting upon the injuries under this head, ceaseless vigilance is required on the part of the officials to prevent the contemptuous indifference of the persons, mostly youths, who are employed in the movement of the mineral underground.

STATEMENT showing the NUMBER of PERSONS KILLED and INJURED by ACCIDENT, together with the NAMES of the OWNERS at whose MINES the ACCIDENTS happened, during the Year 1893, in the SOUTH STAFFORDSHIRE DISTRICT.

Name of Owner of Mine.	Serious Personal Injuries.						Lives Lost.					
	Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above ground.	Total.	Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above ground.	Total.
Aldridge Colliery Co. -	—	4	1	5	—	10	—	—	—	—	—	—
Ashmore Park Colliery Co.	3	3	—	2	1	9	—	1	—	—	—	1
Addenbrooke & Co. -	—	1	1	1	1	4	—	1	—	—	—	1
Bassano, Son, and Hawkes	4	1	—	3	—	8	—	—	—	—	—	—
Bradley, J., and Co. -	—	2	—	—	—	2	—	—	—	—	—	—
Black Lake Colliery Co. -	—	1	—	—	—	1	—	1	—	—	—	1
Bournehills and Withymoor Colliery Co.	—	—	—	—	—	—	—	—	2	—	—	2
Bickley, William - -	—	1	—	—	—	1	—	—	—	—	—	—
Barnett, E. - -	—	1	—	—	—	1	—	—	—	1	—	1
Bould, Joseph - -	—	1	—	—	—	1	—	—	—	—	—	—
Cannock Chase Colliery Co.	—	2	—	2	1	5	—	—	—	—	—	—
Cannock and Rugeley Colliery Co.	—	3	—	1	1	5	—	—	—	—	—	—
Coppice Colliery Co. -	—	2	—	2	1	5	—	—	—	1	—	1
Conduit Colliery Co. -	—	—	1	4	—	5	—	—	—	—	—	—
Cannock and Leacroft Colliery Co.	—	2	1	2	—	5	—	—	—	—	—	—
Cochrane and Co. - -	—	—	—	—	—	—	—	—	3	—	—	3
Cannock Old Coppice Colliery Co.	1	—	—	1	—	2	—	—	—	—	—	—
Coles Farm Colliery Co. -	—	1	—	—	—	1	—	—	1	—	—	1
Challoner, Thomas - -	—	—	—	—	—	—	—	1	—	—	—	1
Cannock Lodge Colliery Co.	—	2	—	1	—	3	—	—	—	—	—	—
Cartwright and Co. -	—	—	—	1	—	1	—	—	—	—	—	—
Dudley, Earl of - -	5	8	—	6	3	22	2	3	—	3	1	9
Dudley Colliery Co. -	—	3	—	—	—	3	—	—	—	1	—	1
Davies, Joseph - -	—	—	—	—	—	—	—	—	—	1	—	1
Dunn, G. H. - - -	—	1	—	—	—	1	—	—	—	1	—	1
Edwards, Job - -	—	1	—	—	—	1	—	—	—	—	—	—
East Cannock Colliery Co. -	—	1	—	2	2	5	—	—	—	—	—	—
Essington Farm Colliery Co.	—	—	1	—	—	1	—	—	—	1	—	1
Ebenezer Colliery Co. -	—	—	—	1	—	1	—	—	—	—	—	—
Fieldhouse, Thomas -	—	—	—	1	—	1	—	—	—	—	—	—
Fishley Colliery Co. -	—	5	1	2	1	9	1	—	—	1	—	2
Grazebrooke, M. and W. -	—	—	—	—	—	—	—	1	—	—	—	1
Garratt and Son - -	—	1	—	2	—	3	—	—	—	—	—	—
Great Wyrley Colliery Co. -	—	4	—	1	—	5	—	1	—	—	—	1
Golds Hill and Springfield Colliery Co.	—	4	1	—	1	6	—	—	—	—	—	—
Greenaway, Javan - -	—	—	—	—	—	—	—	—	1	—	—	1
Hamstead Colliery Co. -	—	3	—	8	2	13	—	—	1	—	—	1
Harrison, William - -	1	1	—	2	—	4	—	—	—	—	—	—
Harrison, G. King - -	—	—	—	—	—	—	—	1	—	—	—	1
Hayward and Co. - -	—	2	2	—	—	4	—	—	—	1	—	1
Hingley, Noah, and Sons -	—	4	—	3	—	7	—	—	—	—	—	—
Hough, John and Son -	—	1	—	—	—	1	—	—	—	—	—	—
Hall, John, and Co. -	—	3	—	2	—	5	—	—	—	—	—	—
Hickman, Alfred - -	—	3	—	1	—	4	—	—	—	—	—	—
Harris and Pearson -	—	—	—	—	—	—	—	—	—	1	—	1
Hall End Colliery Co. -	—	—	—	1	—	1	—	—	—	—	—	—
Holly Bank Colliery Co. -	—	—	—	—	1	1	—	—	—	1	1	2
King, Joseph and Co. -	—	—	—	1	—	1	—	—	—	—	—	—
Knowle Colliery Co. -	—	3	—	2	—	5	—	—	—	—	—	—

Name of Owner of Mine.	Serious Personal Injuries.						Lives Lost.					
	Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above ground.	Total.	Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above ground.	Total.
Lindsley, J. R. - -	—	—	1	—	—	1	—	—	—	—	—	—
Mills, R. and Co. - -	—	1	—	1	—	2	—	—	—	—	—	—
Minton, Francis - -	1	1	—	1	—	3	—	—	—	—	—	—
Marsh, Joseph - -	—	1	—	—	—	1	—	—	—	—	—	—
Norton Cannock Colliery Co.	—	2	1	1	—	4	—	1	—	—	—	1
Newey, John and Co. -	—	—	—	1	—	1	—	—	—	—	—	—
New British Iron Co. -	—	1	—	2	—	3	—	—	—	—	—	—
Newbury Lane Colliery Co.	—	1	—	—	—	1	—	—	—	—	—	—
Patent Shaft and Axletree Co.	—	1	—	—	—	1	—	—	—	—	—	—
Pearson, E. J. & J. -	—	2	—	1	—	3	—	—	—	—	—	—
Pitt, S. H. and Co. - -	—	1	—	1	—	2	—	—	—	—	—	—
Raybould, J., Trustees of -	—	—	—	—	—	—	—	1	—	—	—	1
Rufford and Co. - -	—	1	—	2	—	3	—	—	—	—	—	—
Rowley Station Colliery Co.	—	—	—	1	1	2	—	—	—	—	—	—
Rowley Hall Colliery Co. -	—	—	—	1	—	1	—	—	—	—	—	—
Round Brothers - -	—	—	—	1	—	1	—	—	—	—	—	—
Sandwell Park Colliery Co.	3	8	—	10	2	23	—	—	—	—	—	—
Shrewsbury, Earl of -	—	4	—	4	—	8	—	—	—	—	—	—
Southan Brothers - -	—	2	—	2	—	4	—	—	—	—	—	—
Starkey and Co. - -	—	1	—	2	—	3	—	—	—	—	—	—
Titford Colliery Co. -	—	—	1	—	1	2	—	—	—	—	—	—
Tipper, Joseph - -	—	—	1	—	—	1	—	—	—	—	—	—
Walsall Wood Colliery Co. -	1	2	—	2	—	5	—	1	—	—	—	1
Waterfield, John - -	—	—	—	1	—	1	—	—	—	—	—	—
West Cannock Colliery Co.	—	—	—	2	1	3	—	—	—	—	1	1
Witley Colliery Co. -	—	1	—	3	—	4	—	—	—	—	—	—
Wilkinson, James - -	—	—	1	—	—	1	—	—	—	—	—	—
Williams, Philip, and Son -	2	—	—	—	—	2	—	1	—	—	—	1
Totals - -	21	105	14	99	20	259	3	14	8	13	3	41

Board for Examinations.

During the year the Secretary, Mr. W. Blakemore, junior, who had held that position for some years, resigned, as he was about to leave this country. The Board held a meeting at which they appointed Mr. R. S. Williamson, of the Cannock and Rugeley Colliery, to be the Secretary.

A later meeting was held for the purpose of arranging the preliminaries for the next annual examinations.

These took place at the Mason Science College, Birmingham, on the 9th and 10th January 1894.

Seven candidates offered themselves for 1st class certificates, and 12 for 2nd class certificates. Of these three succeeded in gaining 1st class certificates and eight gained 2nd class certificates.

Prosecutions.

Some occasions arose for putting the law into force against owners and managers of mines under both the Coal and Metalliferous Mines Act. Details are given below :—

	£	s.	d.
The *owner* of the Neachells Colliery for breach of Section 16 (1*b*) of the Coal Mines Regulation Act - - - -	5	0	0 and costs.
Do. do. do. 16 (1*c*)	5	0	0 and costs.
Do. do. do. 57 (1)			costs.
Do. do. General Rule 4 -			costs.
Do. do. do. 5 -			costs.
Do. do. do. 30 -			costs.
The *manager* of the Fishley Colliery for breach of Section 35 (1 (1)) - - - - - -	3	0	0 and costs.
The *owner* of the Park Lane Colliery for breach of Section 16 (1*a*)	3	0	0 and costs.
Do. do. General Rule 25	3	0	0 and costs.
Do. do. do. -	3	0	0 and costs.
The above three charges were repeated upon an earlier date and he had to pay - - - - - -			costs.
The *owner* of the Hatherton Limestone Mine for breach of General Rule 2 (*a* and *b*) of Metalliferous Mines Regulation Act, four charges, in one case - - - - -	10	0	0 and costs.
And in the other three - - - - -			costs.
The *contractor* for the same mine, for the same four charges had to pay in one case - - - - - -	2	0	0 and costs.
And in the other three - - - - -			costs.
The *owner* of the Coles Farm Colliery for breach of Section 16 (1*b*) of the Coal Mines Regulation Act - - -	5	0	0 and costs.
Do. do. do. 16 (1 *c*) -	0	10	0 and costs.
Do. do. General Rule 19	1	0	0 and costs.
Do. do. do. 30	0	10	0 and costs.
Do. do. Special Rule 51	0	10	0 and costs.
Do. do. do. 75	0	10	0 and costs.

I may here state that with one exception, that of the manager of the Fishley Colliery, all these prosecutions were undertaken, with your permission, upon violations of the law discovered during ordinary visits of inspection, without complaint or accident having drawn the inspector's attention to these mines.

Several prosecutions of workmen employed in mines for breaches of discipline, as follows :—

	£	s.	d.
A *stallman* of the Norton Cannock Colliery was fined, for smoking in a part of the mine where safety lamps only were in use - - - - - -	0	10	0 and costs.
A *stallman* of the above Mine, for taking a naked light beyond the lamp station, was fined - - - -	0	5	0 and costs.
A *stallman* of the above Mine, for entering a place which was fenced off, was fined - - - - -	0	1	0 and costs.
Two *workmen* of the Grace Mary Colliery, for breach of General Rule 12 (*b* and *a*) Coal Mines Regulation Act, were fined each - - - - - - -	1	0	0 and costs.
A *workman* of the Brockmoor Colliery, for breach of General Rule 12 (*e*), was fined - - - - -	0	5	0 and costs.
An *engineman* of the Brettell Lane Colliery, for two breaches of Special Rule 86, was fined in each case - -	2	0	0 and costs.
A *workman* of the Essington Farm Colliery, for breach of 35th Special Rule, was fined - - - -	0	10	0 and costs.
A *stallman* of West Cannock Colliery, for ramming a shot with small coal, was fined - - - - -	0	2	6 and costs.
A *stallman* of Norton Cannock Colliery for unramming a shot which had missed fire, was fined - - - -	0	5	0 and costs.
A *horsedriver* of the same Colliery, for entering a road which was fenced off, was fined - - - - -	0	5	0 and costs.
A *stallman* of the same Colliery, for taking a naked light into a district where only safety lamps were used, was fined -	0	10	0 and costs.

Official Duties.

The usual routine work has been constantly carried on during the year. Fatal accidents are invariably investigated first, then injuries, and lastly complaints, according to their apparent importance. Mines where neglect and indiscipline showed themselves upon a visit were re-visited to see if any improvement was manifested. The list of prosecutions goes to prove that the law did not require putting into force many times during the year.

The modern desire for statistics, and the quantity of clerical work, take up a good deal of the time of the inspector in charge, which might be more usefully employed in inspecting mines.

Nevertheless, a large number of visits have been paid to mines and inspections made, both above and below ground. 584 visits were paid for various purposes; 441 mines were visited for purposes of inspection; 344 underground descents were made; 44 inquests were attended; 65 days sick and injured leave, and 36 days holiday were taken.

Explosions of Fire-damp.

Three persons died from the effects of explosions of fire-damp and 21 persons were injured. No. 14 upon the list caused the death of two persons, and it happened at the Himley Colliery of the Earl of Dudley on the 21st April.

At 7.20 on that morning (the work or shift nominally begins at 7 a.m.) three men entered their working place, which was a cross-cut between two roads, having just been told by the deputy that all was right. Now, in accordance with Special Rule 46, such men should, when first entering their working place, examine it with the safety lamp with which they are provided, the precaution being a necessary one. In this case they entered immediately with naked lights and exploded a quantity of fire-damp sufficient to burn the three severely, two of them, as the event proved, fatally. Of course, an infraction of discipline produced this lamentable result, but it is more than probable that this gas had been exuding for some time, and that the examination by the deputy before the work began was of a very perfunctory character. The place was ventilated by a single range of 10-inch air-pipes. In my opinion, all exploring places which are being driven in new and faulty ground ought to be worked with safety lamps, but the law is not sufficiently stringent upon this point. The grip of the managers of such mines as these is not sufficient to insist upon the use of safety lamps, against the objections of the workmen and the opinion of the chartermasters. When the whole of the new ground has been explored, drained, and properly opened out, then the safety-lamps can be withdrawn and naked lights substituted.

The other accident under this head is No. 17, and it happened at the No. 2 plant of the Fishley Colliery on the 5th May. As the Deep Coal face in No. 26 Stall advanced, it was found that a head had been driven before it, but that it had been closely stowed up; but as a workman was holing upon the top of the seam (bannocking) he knocked a hole into a part of this head which had been carelessly left unstowed. Some fire-damp at once rushed out and coming in contact with the naked light, exploded, burning the workman so severely that he died. Another man was also injured.

Just before this accident occurred there had been an entire change of management at this mine, so that the history of this head could not be learnt.

Falls.

In only two of the fatalities which come under this head is any comment necessary, and even then, by no means by way of censure, but only by way of explanation.

No. 24 occurred at the No. 12 Pit of the Wednesbury Oak Colliery on the 18th August at 10 o'clock in the morning, in the Chance coal, which is generally considered to be an offshoot of the thick or 10-yard seam.

Three men had been at work about three hours, and had drawn some timber to drop the top coal. Finding it did not follow the withdrawal of the timber quickly, they ventured under the now unprotected roof, when it immediately fell, and one was fatally and the other two severely injured. Impatience and want of caution produced this lamentable result.

No. 35. In this case the overman of the pit, a careful painstaking practical man, lost his life whilst going his rounds.

The accident occurred in the No. 33 Pit of the Saltwells Colliery of the Earl of Dudley. The thick coal here, owing to an upheaval of the Silurian formation, lies at an angle of 45°. This makes falls of coal the more dangerous, as it cannot be foreseen whither the falling coals

will slide when they have reached the ground. On the afternoon of the 12th December this official was visiting the lowest level in the pit, and had reached the stall where a man was engaged in raking back for the loaders the coals which were lying upon the slope of the "shutt." He was just entering the "bolthole," when a sudden burst was heard by the men, and a huge cubical block, weighing about 25 cwt., was thrown from the cog which supported the high side of the level, and crushed the head of the overman against the lower side of the level. This block of coal was found to be resting upon the man who had been raking, and holding him fast upon the ground, but he was only slightly bruised. It could only have been the sudden settling of the weight from the "shutt" which could have caused this mass to fly off like a battering ram. It is only the huge spaces of the excavations in a thick coal seam which permit such dangerous phenomena to be exhibited.

Shaft Accidents.

These amounted to eight in number during the year.

The first in point of time was the most fatal in result of any accident of any class. It caused three deaths.

At 10.30 p.m. of the 8th February as three men, who had been at work upon the night shift in a pit of the Woodside Colliery, were ascending the shaft, and had nearly reached the top, when the cage in which they were was dashed back to the bottom at such terrific speed that it broke through the sump planks, and the men were either drowned in the water in the sump, or killed by the shock. A hurried search showed that the cage which worked in the other shaft, which should have descended it when the cage containing the men was ascending, was still resting on the legs or catches. The cause of the accident was at once obvious. The night banksman, before signalling to the enginemen to bring the men up, should have gone to the other shaft, only a few yards away, and have satisfied himself whether the catches were in the way of the cage about to descend or not. This he did not do; consequently, when the winding drum began to revolve, the rope attached to this cage uncoiled, and, falling off the drum, got between the teeth of the spur wheels (the drum was upon the second motion), broke several of them, and thus set the drum free. Of course, it at once reversed its motion with the weight of the cage and men. The engineman, hearing the noise, and from his position and the darkness not being able to see what was occurring, lost his presence of mind and quite forgot the drum break, by which he might have retarded the speed of the descending cage and so have saved the men's lives. But the culpable carelessness was on the part of the banksman, who should have seen that the cage in the other shaft was free to descend. The coroner's jury who investigated the case took a lenient view, and merely censured the banksman. This was, if ever there was one, a glaring case, in which no punishment, beyond dismissal from his post, was meted out to an incompetent and careless workman who had caused the death of three fellow workmen.

No. 10 on the list. This accident happened at noon on the 9th March, in a shaft which had been cleaned out to a depth of 22 yards. A loose scaffold was fixed at the Two-feet coal nine yards above, and a man named Stanton was employed in making an inset there. He came out of the pit at 11.0 a.m. and was employed at surface work. Remembering that he had left a good tool down the shaft, he went down upon the scaffold to get it, and at once, on reaching it, he shouted "Pull up." When ascending, and within seven yards of the top, he fell back without a cry, crashing through the scaffold to the bottom. His body could not be recovered for some time, owing to the presence of "black damp," carbonic acid gas. The deceased himself had remarked, shortly before he redescended, that "it was getting thick "before I came up." The feeble ventilation by air pipes was no doubt overpowered by the exuding gas.

No. 11 on the list. This occurred in the working shaft of the Wallface Pit of the Coles Farm Colliery. Danks, the cager, had been at work at the Brooch Coal Inset only half an hour. The practice has been to take the empty tub from the cage at the Brooch level, then to run the empty cage to the bottom to allow the water tank in the other shaft to discharge at the top of the other pit. Then, if the cage is wanted at the Brooch Inset, the cager signals for it and it comes to rest there. Shortly after, a driver coming out of the workings, found the fence gate open, the legs hooked back, the cage standing a little below the inset, and the full tub and cager nowhere to be seen. A search 53 yards below found the dead body of the cager, with the tub, in the water. Why the cager should attempt to push a full tub towards the shaft, when he must easily have seen that the cage was not there, cannot now be explained.

No. 32 on the list. At 7.30 p.m. on the 23rd October, some men who were at work near the bottom of the shafts of the Bournehills Colliery heard a great noise in one of the shafts' and on going to ascertain the cause, they found that a tub of bricks had fallen down, and on further search they also found the two dead bodies of the watchman Tibbetts and his labourer Phillips. The engineman on the surface was also just then looking for them, as he had missed them and had found the shaft gate up, the pit top exposed, and a man's cap upon the sill at the back of the shaft. What these two men could have been doing to push a tub full of bricks into the shaft and to follow it, will never be known. The man Phillips had only come there that evening for the first time to work.

Miscellaneous.

Accident No. 1 upon the list. This took place at the Holly Bank Colliery. A labourer, who was employed underground between the two shafts, was seen to pass through the main separation doors, to seek, as he said, for a tool which he knew was hidden there. He was heard to scream, and on going to his aid, it was found that he had been drawn by the full rope around the vertical turn pulley at the bottom of the upcast shaft, and one leg was nearly severed. He sank under his injuries and died next day. A life thrown away by disobedience to the special rule which forbids any workman from leaving his place of work and wandering into another.

No. 13 upon the list. This life was lost through want of presence of mind. The underground machinery examiner was, with the signal boy, examining a signal bell at the foot of a self-acting incline, when the signal was given that the full sett had broken away from the top. Instead of stepping into a refuge hole which was close at hand—one of such refuges as are provided under the regulations—they both turned to run down the incline. The boy reached the next level and escaped, but the examiner was caught by two full tubs and killed. The incline man at the top explained that as he knocked out the stop blocks which retained the tubs at the top, and as they began to move, two became uncoupled and ran amain.

No. 19 upon the list was caused by an explosion of gunpowder. A man, who was employed in driving a stone drift or rockhead, had drilled a hole and had placed in it about $\frac{7}{8}$ths of a lb. of compressed powder, when it exploded. From the fact that the rammer was lying by the side of the head, uninjured and unmarked, and from other little signs, I came to the conclusion that the poor fellow had been examining the hole, after he had put the powder in, with his naked light, and as the cartridge paper covers had been pulled from the powder cylinders, *because the workmen held the opinion that the powder would not explode so easily with the paper covers on*, and as, in consequence, grains of powder had fallen all along the bottom of the hole forming a train, and upon this a spark from the candle fell, hence the explosion.

But what most exercised my mind was the fact that the unrammed powder had done its work and had blown the rock, an argillaceous sandstone. It had also committed the other vagaries in this small mine which are so familiar to those who have had experience of the effects of a blown-out shot.

With the consent of Mr. H. C. Peake, the managing director of the Walsall Wood Colliery Company, I made a number of experiments with compressed blasting powder in the marl quarry at Walsall Wood Colliery, with a view of determining, if possible, whether this powder in an unrammed hole, could, whilst exhibiting the phenomena of a blown-out shot, also do the work which it had been intended it should do. I have, however, to admit that I could not reproduce the conditions found in the mine after the explosion.

No. 21 on the list was caused by an exploding shot. At the angle of junction of two roads in the Thick Coal seam of the No. 28 Pit of the Earl of Dudley's Saltwells Colliery, it had been determined to take off a piece of coal to enable the curve of the tub tramway to be eased. A shot had been put into this angle at 7 p.m. of the 28th July, and the fuse having been lighted, the man who fired it retreated to the dip side to warn his horse driver. At the inquest the question naturally arose as to the reason why he had not also barred the rise side of the shot, when he explained that before firing the shot he had gone to the rise and had shouted to warn anyone who might be within hearing, and getting no answer he was satisfied, as, knowing it not to be a regular travelling way, he did not expect anyone coming down that way. This, however, did happen, for the night deputy going his rounds took this road as a short cut with another man who followed him, and just as he got in the line of fire and only three or four yards from the shot, it exploded, and he was fatally wounded, the other man having a most miraculous escape. This occurrence only serves to show how necessary it is to bar access to a shot on both sides when it is so placed as to be open on both sides.

No. 28 on the list again was caused by exploding powder. On the 4th October a pikeman in the Warren's Hall Pit of the Earl of Dudley's Coneygre Colliery was in the act of inserting

a compressed powder cartridge in a shothole when it exploded, burning him fatally and another man slightly. Then it was discovered, when too late, that he was short-sighted, and was, no doubt, holding his candle close to the hole when inserting the powder, and a spark flew upon it. If this man's infirmity had been known he would not have been permitted to handle an explosive.

No. 30 on the list. A horse driver, in bringing out a tub to the shaft on a dip gradient of 1 in 18, forgot to put a "locker" into the wheels to act as a drag. He was in front of it, and finding the speed increasing, as he reached the shaft-siding, he turned his horse into the empty road, no doubt having an idea this would throw the tub off the rails; but the trace chain became detached, and the horse was saved, but the driver was swept onward and fell into the cagehole with the full tub upon him and was killed. The assistant cager made a plucky attempt to arrest the tub as it passed him, but he was thrown on one side uninjured. The blocks, which were in position, were cleared away, so great was the speed of the tub. Special Rule 28 of the Code, which is in force at this mine, requires that drivers "shall "carefully convey their loaded and empty tubs," and the failure, in this case, to comply with this requirement caused the loss of a life.

No. 36 upon the list. This case revealed considerable carelessness upon the part of a stallman, great want of supervision by the fireman, and weakness of discipline upon the part of the management. Two stalls, Nos. 18 and 23 in the Shallow Coal seam of the No. 3 Plant of the Fishley Colliery, had their working faces advancing at an obtuse angle, and one, No. 18 stall, was a "bannocking" stall, and No. 23 was worked by undercutting or holing. At 9 a.m., on the 14th December, as two firemen were passing through No. 23 stall, word was passed from No. 18 that a shot was about to be fired Without making any further inquiry these firemen retreated, passing the word to the workers in No. 23 stall to get into a place of safety, whilst they went round to No. 18 stall, but when they arrived the shot had been fired. Now, owing to the different methods of working, it had been found necessary to leave a thin rib of coal 4 feet 6 inches thick between the two stalls, whilst for convenience and ventilation, a small hole was knocked through this rib at intervals, as the face advanced. It appears to have occurred to the practical knowledge of the stallman of No. 18 stall that a shot would more effectually, and with less muscular labour, drive a hole through this rib, so he proceeded to drill a shot hole of 4 feet in depth in a rib of coal 4 feet 6 inches thick, thus only leaving a heel or breech to the shot of 6 inches. He charged it with 1½lb. of powder, a powerful charge. If my description has been followed, it will be understood that this shot was aimed, as the line of fire, *along* the wall face of No. 23 stall. Two men were loading a tub at the way end of this stall, and after receiving the warning, naturally concluded that they were safe, as no one had told them that it was other than a face shot, with its line of fire at right angles to their position. The shot was fired; it acted as a blown-out or blown-through shot. The heel or breech of the shot hole, being the line of least resistance, gave way, and the coal which formed it rushed like a charge of grapeshot along the face of No. 23 stall, struck a man who was quietly loading his tub at the way end, and so seriously injured him that he died. The other man, being protected by the tub, escaped with some bruises. At the inquest it was admitted that, in this pit, shots were always fired by the stallmen quite at their own discretion, without supervision of any kind by the firemen. If this supervision had been intelligently applied by the firemen who were on the spot, this shot would never have been fired. In my opinion, it was a reckless act to fire it. The manager, who has not long been appointed to this post, acknowledged that he had intended to stop shot firing, except under careful supervision, but that, owing to the strike, he hesitated to give such an order, for fear his men should cease work and so show their resentment. If this mine had been *dry* and *dusty*, instead of being moist, the consequences would have been disastrous to the whole pit's company. It may be laid down as a good useful rule that in no mine should a shot be fired until the site of, and intention of that shot has been judged of by a competent official, and permission to fire it been given by him.

Accidents upon the Surface.

No. 3 upon the list. As a locomotive which works upon the tub tramway between the Earl of Dudley's Lye Cross Pit and the Coneygre Furnaces was performing, on the 16th January, at 10 a.m., what is known as the "fly shunt," the locomotive left the rails and turned so sharply to one side that it became reversed end for end and fell over upon its side. The fall caused a fracture of the dome and an internal pipe, which allowed the steam and scalding water to escape. The cab, as it is called, on such a small engine, being also small, did not admit of the ready escape of the driver and stoker, father and son, both of whom were

severely scalded, the son, as the result proved, fatally. A careful examination of the locomotive and the tramway revealed no defect to account for its jump from the rails. The suggestion of the manager of the Castle Mill, the Earl of Dudley's engineering works, which may partly account for the accident, was, that on steam being suddenly put on full to perform the "fly shunt," the engine having a short wheel base, would oscillate longitudinally, and so lift the forward wheels from the rails. A slight lateral movement would account for the remainder of the accident.

The other two deaths from accident were those of an engine fitter at the Holly Bank Colliery, and of a surface foreman at the West Cannock Colliery. The former was found dead in the engine pit of the locomotive shed, having fallen backwards from the ladder which he had placed against the wall to do some repairs. The latter, who had once before been injured in a similar way, in a moment of forgetfulness, allowed himself, as it seemed, to be crushed between the buffers of two railway trucks, the movement of which he was superintending.

Deaths from other Causes.

Isaiah Rogers (38), an engineman, was watching, only as a spectator, the dismantling of a horse gin at the Horseley Colliery, when it suddenly collapsed and the beam, striking him upon the head, killed him.

John Hobbs (64) foreman of the brickmakers at the brickyard belonging to the Heath End Colliery, Pelsall, was smothered whilst crossing over a part of the surface which had been undermined by the extraction of the coal. The ground gave way under him, and he fell into the hole and was buried.

Selina Woodhouse and *Elizabeth Johnson* were both killed, and another woman and child were injured when burrowing in the pit mound at Foxoak Colliery, by the falling in of the cave upon them which they had formed whilst searching for small coal.

Thomas Ruff (53), when sawing timber in No. 69 Road in the eight feet seam of the Holly Bank Colliery, suddenly fell backwards, and when picked up he was quite dead. The cause was heart disease. It occurred on the 19th April.

Frederick Marshall (55), chaff-cutter at the Norton Pits of the Conduit Colliery, about 2 p.m. of the 1st August, was found dead near the stable door. As this man had been ailing for some time, no doubt the cause of death was natural.

William Law (13), was dancing upon the brick dome of a disused pit shaft in the Doe Bank Colliery on the 21st August, when the brickwork gave way and he fell in. The foul air in the shaft and the fall killed him. He was trespassing at the time.

William Harris (52), on the 9th October, when sitting at the mouth of the shaft at Dairy Farm Colliery waiting to descend, died suddenly.

William Doughty (52), when at work underground in the working face of Coppy Hall Colliery, complained of violent pains in the head, became unconscious, was taken home and died. The doctor gave the cause of death as effusion of blood on the brain.

Ellen Marston on December 22nd, when picking coal from an abandoned coal quarry face at Albion Colliery, Willenhall, was killed by the fall of the overhanging sand and gravel.

Harry Oakes (30), stoker, whilst getting hot ashes from under the boiler at the Ramrod Hall Pit of the Coneygre Colliery on the 12th December, was seized with a fit and fell forward with his face upon the ashes in the barrow and when lifted up he was found to be dead.

Complaints.

The usual careful attention has been given to all complaints, whether anonymous or not.

An anonymous complaint of the insecure condition of the working shaft at the Clifton Colliery. This was found to be quite true; the owner promised to repair it and it is now made safe.

An anonymous complaint of the unsafe state of the gin and its chain, which is used as the "proper apparatus" for the purpose of raising the workmen from the mine, in case the winding engine fails. This gin was inspected and found to be in fair order, but the chain was so rusty that its strength could not be guaranteed. The owner replaced the chain with a rope. This was at the Chillington Colliery, and as the ventilation of the mine was also complained of, the pit was carefully inspected and the air current was found to be good in every working place.

An anonymous complaint of the want of "proper apparatus" at the Coppy Hall Colliery. The winding engine which was kept for that purpose was, by the careless act of the engine-

man at 10 p.m. on the 29th April, nearly destroyed and rendered useless. Another temporary engine was, as soon as possible, put in position, and now the other has been repaired and improved.

An anonymous complaint of inadequate ventilation at the Ladymoor Colliery and of workmen having been rendered insensible by firestink or the gases from spontaneous combustion. The No. 2 Pit of this colliery, which was working the Thick Coal seam, was understood to be meant by this complaint. The air current of this pit was heavily charged with carbonic acid gas, the manager pleading as an excuse that he dared not force any more air through the workings for fear of teasing up the breeding spontaneous combustion. He was strongly warned as to the consequence if he did not provide better ventilation.

"A poor working man," in an anonymous communication and in a handwriting evidently feigned, complained of various irregularities at the White's Farm Pit of the Coles Farm Colliery. Upon inspection several violations of the Act were discovered, and the result is recorded under the head of "prosecutions."

An anonymous complaint that there was only one shaft at Scotwell Colliery. Upon investigation it was found that there are two shafts at this mine, and that as they were re-opening them time must be allowed for the work.

An anonymous complaint that the top of the shaft at Far Close Colliery was not fenced, that there was neither barometer nor thermometer, that there were no rules posted up.

The pit top was found to be safely fenced; there was neither barometer nor thermometer; the rules were hung up only in the owner's office, which was not a place convenient for the workpeople. These matters have now been adjusted.

A complaint of the condition of No. 1 shaft at Aldridge Colliery and of an underground fire. This shaft is certainly out of perpendicular, and the brickwork shows signs of having been rubbed by the cage. The agent is now giving his close attention to this matter. The underground fire has been dammed off.

Exemptions.

An exemption from the weighing provisions of the 50 & 51 Vict. c. 58, s. 12 (3) was granted by the Secretary of State to the No. 15 pit of the Dock Meadow Colliery, Bilston, upon the joint representation of the owner of and of the persons employed in the mine. The date of the exemption was the 8th April 1893.

An exemption was granted by me, as the inspector of the district, to the No. 2 shaft of the Park Lane Colliery, from the provision of General Rule 25 of the Act requiring guides until the 1st August 1893. The exemption bore date the 28th June 1893.

Metalliferous Mines.

These Silurian limestone mines do not afford matter for an eventful report. The working places only creep onwards. Only four injuries have been reported: a slight one from a fall of roof, one from falling from the bench of limestone upon which he was working, one from the explosion of an ammonite shot, which was being rammed, probably too hard, and one from the explosion of a powder shot which was judged to have grit in the drill hole.

The list of fatal accidents accompanies this report, as does also the formal report of the Inspector Assisting (Mr. Pickering) under the Metalliferous Mines Regulation Act.

I have, &c.,
W. BEATTIE SCOTT.

The Right Honourable H. H. Asquith, Q.C., M.P.,
Her Majesty's Principal Secretary of State,
Home Department, London.

COAL MINES REGULATION ACT.

LIST of ACCIDENTS, and LOSS of LIFE arising therefrom, in the SOUTH STAFFORD DISTRICT, to December 31st, 1893.

Date.	No. of Accidents.	Name of the Mine or Colliery.	Where situate.	Owner's or Company's Name.	Persons Killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Fire-damp.	Lives lost. Falls of Roof and Sides.	Lives lost. In Shafts.	Lives lost. Miscellaneous Underground.	Lives lost. Above ground.	Lives lost. Total.
1893. Jan. 2 4.0 p.m.	1	Essington -	Wolverhampton (co. Stafford).	Holly Bank Colliery Co.	Emmanuel Broomhall.	17	Labourer -	Drawn by rope into turn pulley. Died January 3.	–	–	–	1	–	1
Jan. 12 11.30 a.m.	2	Saltwells -	Dudley - - (co. Stafford).	Earl of Dudley - -	Geo. Felton -	38	Loader -	Fall of coal. Cause, a "bump" and previously unseen "slips."	–	1	–	–	–	1
Jan. 16 10.0 a.m.	3	Coneygre -	Dudley - - (co. Stafford).	Earl of Dudley - -	Sam. Danks, junior	18	Stoker -	Locomotive capsized and he was scalded by the steam from a broken pipe. Died January 18.	–	–	–	–	1	1
Jan. 18 1.45 p.m.	4	Nager's Field -	Brettell Lane - (co. Stafford).	G. King Harrison -	N. Geary -	29	Pikeman -	Fall of roof (broad earth) in a fire-clay pit. Died January 19.	–	1	–	–	–	1
Jan. 19 8.0 a.m.	5	Netherton, Old	Dudley - - (co. Worcester).	M. & W. Grazebrook -	Marshall Round -	37	Pikeman -	Fall of coal from brow of Thick Coal opening.	–	1	–	–	–	1
Feb. 8 8.30 a.m.	6	Norton Cannock	Bloxwich - - (co. Stafford).	Norton Cannock Colliery Co.	John Yarnold -	63	Dataller -	Fall of roof when improperly drawing timber. Died March 14.	–	1	–	–	–	1
Feb. 8 10.30 p.m.	7	Woodside -	Dudley - - (co. Worcester).	Cochrane & Co. - -	John Oliver - - Jos. Jones - - Aaron Crewe -	54 42 56	Pikeman - Do. Do.	Run down shaft with cage into sump. *See* report.	–	–	3	–	–	3
Mar. 4 10.45 a.m.	8	Horseley -	Tipton - - (co. Stafford).	Thos. Challoner - -	David Colbourn -	22	Loader -	Fall of coal - - -	–	1	–	–	–	1
Mar. 4 11.5 p.m.	9	Eagle - -	Old Hill - - (co. Stafford).	Eagle Colliery Co. -	Rich. Turner -	18	Loader -	Crushed by empty tubs in a dip plane. Died March 7.	–	–	–	1	–	1

List of Accidents, &c.—*continued.*

Date.	No. of Accidents.	Name of the Mine or Colliery.	Where situate.	Owner's or Company's Name.	Persons Killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost.					
									Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above ground.	Total.
1893. Mar. 9. 12 noon.	10	Birds Leasow -	Pensnett - - (co. Stafford).	Javan Greenaway -	Thos. Stanton -	35	Pikeman -	Suffocated in shaft by foul air -	–	–	1	–	–	1
Mar. 17 7.30 a.m.	11	Coles Farm -	West Bromwich (co. Stafford).	Coles Farm Colliery Co.	Ben. Danks - -	26	Cager -	Fell into sump from mid inset -	–	–	1	–	–	1
Mar. 21 9.0 a.m.	12	Great Wyrley	Cannock - - (co. Stafford).	Great Wyrley Colliery Co.	Roland Rolands -	20	Loader -	Crushed against a tree by fall of coal from working face.	–	1	–	–	–	1
Mar. 23 10.30 a.m.	13	Coppice - -	Brownhills - (co. Stafford).	Coppice Colliery Co. -	William Kingston -	56	Examiner -	Run over by tubs at foot of incline -	–	–	–	1	–	1
Apr. 21 7.20 a.m.	14	Himley - -	Pensnett - - (co. Stafford).	Earl of Dudley -	C. Portman - -	39	Pikeman -	Died April 26. Explosion of fire-damp.	2	–	–	–	–	2
					J. Luton -	33	Do. -	Died April 29.						
Apr. 28 6.50 a	15	Black Lake -	West Bromwich (co. Stafford).	Black Lake Colliery Co.	T. Phillips - -	49	Pikeman -	Fall of rock - - -	–	1	–	–	–	1
Apr. 29 1.0 p.m.	16	Ashmore Park	Wednesfield - (co. Stafford).	Ashmore Park Colliery Co.	W. Willetts - -	45	Stallman -	Fall of coal. Died July 25 -	–	1	–	–	–	1
May 5 10.30 a.m.	17	Fishley - -	Bloxwich - - (co. Stafford).	Fishley Colliery Co. -	Dan. Harvey -	44	Pikeman -	Explosion of fire-damp. Died May 13.	1	–	–	–	–	1
M y 6 3.0 p.m.	18	Brickhouse -	Netherton - (co. Stafford).	G. H. Dunn - -	Emmanuel Barnett	28	Horse-driver	Crushed against side of road by a tub.	–	–	–	1	–	1
Ma 19 12 noon.	19	Turner's Lane -	Stourbridge - (co. Stafford).	Harris and Pearson -	Henry Holt - -	27	Pikeman -	Explosion of powder. Died May 20.	–	–	–	1	–	1
May 25 12.30 p.m.	20	Pelsall - -	Walsall - - (co. Stafford).	Walsall Wood Colliery Co.	W. Smith - -	42	Stallman -	Fall of roof from three converging slips.	–	1	–	–	–	1

List of Accidents, &c.—*continued.*

Date.	No. of Accidents.	Name of the Mine or Colliery.	Where situate.	Owner's or Company's Name.	Persons Killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above ground.	Total.
1893. July 28 7.0 p.m.	21	Saltwell - -	Dudley - - (co. Worcester).	Earl of Dudley -	W. Jones - -	32	Deputy -	Explosion of powder. Died August 3	–	–	–	1	–	1
Aug. 7 12.20 a.m.	22	Essington Farm	Bloxwich - - (co. Stafford).	Essington Farm Colliery Co.	Thomas Jerry -	28	Incline-man	Crushed between tubs - -	–	–	–	1	–	1
Aug. 14 12.30 p.m.	23	Horseley -	Tipton - - (co. Stafford).	W. J. Hayward -	John Badley -	54	Pikeman -	Severely strained his arm when at work, and gangrene supervening he died on 20th August.	–	–	–	1	–	1
Aug. 18 10.0 a.m.	24	Wednesbury Oak	Tipton - - (co. Stafford).	Phillip Williams & Son	Jos. Martin - -	35	Loader -	Fall of coal by which two others also were injured.	–	1	–	–	–	1
Sept. 4 8.30 p.m.	25	Hamstead -	Great Barr - (co. Stafford).	Hamstead Colliery Co. -	Thomas Carter -	38	Dataller -	Fell from scaffold into sump of upcast shaft.	–	–	1	–	–	1
Sept. 5 4.0 p.m.	26	Holly Bank -	Wolverhampton (co. Stafford).	Holly Bank Colliery Co.	Tom Burn - -	35	Fitter -	Fall from ladder in locomotive shed	–	–	–	–	1	1
Sept. 23 11.30 a.m.	27	Saltwell - -	Dudley - - (co. Stafford).	Earl of Dudley -	John Lawley -	34	Pikeman -	Avalanche of coal on a slope of 35°	–	–	–	1	–	1
Oct. 4 11.0 a.m.	28	Coneygre -	Dudley - - (co. Stafford).	Earl of Dudley -	D. Grainger - -	—	Pikeman -	Premature explosion of powder. Died October 7.	–	–	–	1	–	1
Oct. 13 12 noon	29	Himley - -	Dudley - - (co. Stafford).	Earl of Dudley - -	J. Bennett - -	39	Loader -	Fall of coal from side - -	–	1	–	–	–	1
Oct. 14 7.45 p.m.	30	Coppy Hall -	Walsall - - (co. Stafford).	Edward Barnett -	John Weals - -	15	Horse-driver	Run into sump by tubs - -	–	–	–	1	–	1

List of Accidents, &c.—*continued.*

Date.	No. of Accidents.	Name of the Mine or Colliery.	Where situate.	Owner's or Company's Name.	Persons Killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above ground.	Total.
1893. Oct. 19 3.45 p.m.	31	Bromley - -	Pensnett - - (co. Stafford).	Trustees of J. Raybould	Edward Hollingsmold.	34	Loader -	Fall of roof and timber - -	–	1	–	–	–	1
Oct. 23 7.30 p.m.	32	Bournehills -	Netherton - (co. Stafford).	Bournehills and Withymoor Colliery Co.	Joseph Tibbetts - Jos. Phillips -	65 24	Watchman - Labourer.	Fell down shaft from surface -	–	–	2	–	–	2
Nov. 15 6.30 a.m.	33	Ocker Hill -	Tipton - - (co. Stafford).	Addenbrooke & Co. -	Isaac Forster -	42	Overman -	Fall of roof while examining workings.	–	1	–	–	–	1
Nov. 27 1.0 p.m.	34	West Cannock -	Hednesford - (co. Stafford).	West Cannock Colliery Co.	Rich. Ellis - -	54	Foreman -	Crushed between two loaded trucks	–	–	–	–	1	1
Dec. 12 2.30 p.m.	35	Saltwell - -	Dudley - - (co. Stafford).	Earl of Dudley - -	Alf. Allport - -	45	Overman -	Fall of coal when going his rounds	–	1	–	–	–	1
Dec. 14 9.0 a.m.	36	Fishley - -	Bloxwich - - (co. Stafford).	Fishley Colliery Co. -	G. C. Starkey -	35	Loader -	Blown out shot - - -	–	–	–	1	–	1
Dec. 21 8.45 a.m.	37	Buffery - -	Dudley - - (co. Worcester).	Dudley Colliery Co. -	Jas. Probert -	73	Dataller -	Run over by tub at foot of incline -	–	–	–	1	–	1
								Total - - -	3	14	8	13	3	41

Compton, Wolverhampton,
20th January 1894.

Sir,

In pursuance of Section 20 of the Metalliferous Mines Regulation Act, 1872, I have the honour to report to you that during the year 1893 I exercised the duties of an Inspector of Mines in the district of South Staffordshire, and that in so doing I acted as Assistant to and under the directions of Mr. W. Beattie Scott, the Chief Inspector of the district.

I have, &c.,
W. H. PICKERING.

To the Right Hon. the Secretary of State,
Home Department, Whitehall, London.

REPORT

OF

JOSEPH T. ROBSON, Esq., H.M. INSPECTOR OF MINES

FOR THE

SOUTH WALES DISTRICT (No. 13),

TO

HER MAJESTY'S SECRETARY OF STATE,

UNDER

**The Coal Mines Regulation Act, 1887,
the Metalliferous Mines Regulation Acts, 1872 and 1875,
and the Slate Mines (Gunpowder) Act, 1882;**

For the Year 1893.

Presented to both Houses of Parliament by Command of Her Majesty.

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Mr. Robson's Report.

REPORT ON THE INSPECTION OF MINES IN THE SOUTH WALES DISTRICT, COMPRISING NEARLY THE WHOLE OF GLAMORGANSHIRE, PART OF BRECONSHIRE, THE WHOLE OF CARMARTHENSHIRE, AND OF PEMBROKESHIRE UNDER THE COAL MINES REGULATION ACT, 1887, WITH THE STRATIFIED IRON STONE MINES (GUNPOWDER) ACT, 1881, AND THE AMENDING ACT, 1886; AND ALSO THE METALLIFEROUS MINES REGULATION ACTS, 1872 AND 1875, WITH THE SLATE MINES (GUNPOWDER) ACT, 1882; FOR THE YEAR 1892.

SIR, Swansea, February 23rd, 1894.

IN pursuance of section 43 of the Coal Mines Regulation Act, 1887, I have the honour to submit my seventh annual report as Inspector of Mines in charge of the South Wales District, for the year ended 31st December 1893.

The coal trade was, on the whole, fairly good throughout the year, and with the exception of about five weeks in August and September, during a wages strike inaugurated by the hauliers in the Ogmore and Rhondda Valleys, but eventually affecting nearly the whole of the Glamorganshire collieries, the mines worked pretty regularly. Miners' wages were regulated as before by a sliding scale. At the beginning of the year wages were 22½ per cent. above, and at the close 20 per cent. above the standard of 1879, with some slight fluctuations between.*

The only new winnings of importance commenced during the year were that in the Aber Valley, in the parish of Eglwysilan, by the Universal Colliery Company, Limited, and that at Dinas Main, Gilfach Goch, both in Glamorganshire. The new shafts being sunk by the Dowlais Iron Company, at Aberdare Junction, have not yet reached the steam coals, considerable difficulty having been experienced in dealing with the large quantity of water met with. At the new winning by the Main Colliery Company, Limited, near Neath, the Graigola seam has been reached at a depth of 435 yards and coal is now being raised. At several other collieries additional shafts are being sunk, and at others, where the upper seams are becoming exhausted, the shafts are being sunk down to lower measures.

The list of mines under the Coal Mines Regulation Act, compiled from notices and returns received from owners and corrected to the end of the year, shows that there were then 366 mines at work in the district.

Alterations have taken place in the ownership of some important collieries. Harris' Deep Navigation Colliery, which has the deepest shafts in the South Wales coalfield, has been acquired by the Ocean Coal Company, Limited. The collieries belonging to Messrs. A. Tylor and Company, Limited, have been taken over by Messrs. D. Davis and Sons, Limited, Ferndale; while the Gelli, Tynybedw, Pentre, Resolven, and Aber collieries are now owned by Messrs. Cory Brothers and Company.

The number of separate owners or firms stands now at 240 as compared with 235 at the end of the previous year.

MINERALS WROUGHT.

The output of coal, which had risen steadily since the year 1886, received a check last year, the quantity raised being nearly a million tons less than in 1892. The strike in the summer no doubt resulted in a greater loss of output than the difference between that of the two years, but part of this loss was made up in the latter months after work was resumed.

* A further advance of 6¼ per cent. was made on 1st February 1894.

The following table shows the output of the different minerals for the past year, and, for comparison, that of the previous year, with the respective increase or decrease:—

Produce.	1893.	1892.	Increase.	Decrease.
	Tons.	Tons.	Tons.	Tons.
Coal - -	22,239,947	23,204,236	—	964,289
Fireclay - - -	146,264	146,201	63	—
Ironstone - -	18,495	22,299	—	3,804
Shale, &c. - -	16,630	26,239	—	9,609
Total -	22,421,336	23,398,975	—	977,639

Of the coal 1,262,934 tons was anthracite, which is 46,767 tons less than the production in 1892. This decrease may be accounted for by a prolonged strike at the Great Mountain Colliery, Tumble, Carmarthenshire.

The reduction altogether in minerals raised amounted to 4·1 per cent.

Persons Employed.

(A.), (B.) and (C.)

The following table, compiled from the annual returns, gives the number of persons employed for the past and preceding years, with the increase or decrease, respectively:—

——	1893.	1892.	Increase.	Decrease.
Underground:				
Boys 12 to 16 - -	7,462	7,889	—	427
Males above 16 - -	65,835	67,401	—	1,566
Total - - -	73,297	75,290	—	1,993
Above-ground:*				
Boys 12 to 13 - -	19	15	4	—
Girls 12 to 13 - - -	—	—	—	—
Boys 13 to 16 - -	628	631	—	3
Girls 13 to 16 - -	20	29	—	9
Females above 16 -	336	328	8	—
Males above 16 - -	12,481	12,546	—	65
Total - -	13,484	13,549	—	65
Total above and below ground	86,781	88,839	—	2,058

It will be seen that there was a considerable reduction in the number of persons employed underground, the first which has taken place for many years. This reduction amounted to 2·6 per cent. on the number employed in the year 1892. The net reduction in the total number employed above and below ground was 2·3 per cent.

The output per person employed, which in the previous year had been 266 tons, fell last year to 261 tons.

Fatal Accidents and Deaths.

(A.), (B) and (C.)

The total number of fatal accidents was 150, and the deaths resulting therefrom 229.

			Lives.
1 fatal accident	caused the loss of	- - - - -	63
1 ,,	,,	- - - - -	8
1 ,,	,,	- - - - -	4
1 ,,	,,	- - - - -	3
5 fatal accidents	,,	2 lives in each accident - -	10
141 ,,	,,	1 life ,, - - -	141

* The persons employed on private branch railways, and in washing and coking coal on premises adjacent to or belonging to the mines are now included, and have been added to the figures for the previous year for proper comparison.

As regards the number of separate fatal accidents, this was 26, or 14·8 per cent., less than in the preceding year; a gratifying reduction when that of the output (4·1 per cent.) and that in the number of persons employed (2·3 per cent.) are taken into account. The comparison is even more favourable when the number is compared with that of 1891, in which year there were 185 separate fatal accidents, the highest figure in any year. The average for the five years ending 1890 was 147, and for the five years ending 1885 it was 143.

The number of deaths from fatal accidents, although 76 less than in the preceding year, when 112 lives were lost in one explosion, is a large one. The number in 1891 was 198; the average for the five years ending 1890 was 181, and for the five years ending 1885 it was 171. Last year's number, 229, has been exceeded thrice during the past 25 years, viz.: in 1880, when 243 lives were lost; in 1890, when 242 lives were lost; and in 1892, when the deaths reached 305.

The following table shows the number of fatal accidents and deaths under their usual headings, and, for comparison, the numbers for the preceding year, with the increase and decrease respectively:—

—	1893.		1892.		Increase.		Decrease.	
	Accidents.	Deaths.	Accidents.	Deaths.	Accidents.	Deaths.	Accidents.	Deaths.
By explosions of fire-damp -	1	1	2	113	—	—	1	112
„ falls - - - - -	82	84	83	88	—	—	1	4
In shafts - - - -	11	21	25	27	—	—	14	6
Miscellaneous underground -	37	103	45	53	—	50	8	—
On surface - - - -	19	20	21	24	—	—	2	4
Total - -	150	229	176	305	—	—	26	76

It will be seen that as regards "accidents" the decrease, although small under three of them, applies to each of the headings. With respect to "deaths," the increase of 50 under "Miscellaneous underground" would, but for the single accident which caused the loss of 63 lives, have been a decrease of 13.

The following general results are arrived at from the foregoing tables:—

(1.) One fatal accident occurred among every 578 persons employed in and about the mines.

(2.) One death resulted therefrom in every 379 persons employed in and about the mines.

(3.) One fatal accident occurred for every 149,475 tons raised.

(4.) And one death resulted therefrom for every 97,910 tons raised.

As in former years I give below a table showing the comparison between the district, the average of the United Kingdom, and the Durham District, which last year showed the best results.

—	South Wales district.	Average of United Kingdom.	Durham district.
Number of persons employed per fatal accident -	576	844	1,054
„ persons employed per life lost - -	376	644	990
„ tons raised per fatal accident - -	150,478	216,609	350,862
„ tons raised per life lost - -	98,339	165,318	329,915

I append a list of the fatal accidents which, as in former years, have been tabulated under each owner or firm.

Only one fatal accident occurred amongst the small mines employing not more than 30 persons underground, and not under the care of a certificated manager. In the preceding year not a single fatality occurred in any of these mines.

The 150 fatal accidents happened at 97 different collieries; thus, there were 269 mines worked during the year at which no fatality occurred.

Non-Fatal Accidents and Injuries.

(A.) and (B.)

The number of non-fatal accidents reported during the year was 438, which caused more or less serious injury to 473 persons. In addition to these, 13 persons were injured by accidents which proved fatal to others.

——	By Explosions of Fire-damp.	By Falls of Roof and Sides.	By Shaft Accidents.	Miscellaneous Underground.	On Surface.	Total.
Number of non-fatal accidents	14	224	16	147	37	438
Number of persons injured by these accidents	31	225	25	155	37	473
Number of persons injured by accidents which proved fatal to other persons	—	5	2	3	3	13
Total number of persons injured (exclusive of fatalities)	31	230	27	158	40	486
Total for preceding year	38	242	24	187	48	539

Explosions of Fire-damp.

The past year was remarkable in its freedom from explosions of fire-damp and their frequent terrible results, inasmuch as only one life was lost from this cause. This is the best result attained, at any rate during the past 25 years, and probably in any year since mining on a large scale was inaugurated in South Wales. When the vast output is considered, and the large number of persons employed underground in producing it, together with the fact that this output is worked almost entirely from mines more or less gaseous, this is a satisfactory result. It proves that, with skill and care, it is possible to work such mines safely in this respect.

The fatal explosion occurred on the 11th of February at Werfa Colliery, near Aberdare, and was of a rather unusual nature. The colliery is over 30 years old, and works the lower steam coals at a depth of 167 yards from the surface. Below the bottom landing there is a sump of 9⅓ yards, which was covered with a stage formed of planks fixed six feet below the landing. On a Saturday evening the deceased, who was hitcher at the landing, was clearing away the rubbish which had accumulated on the stage, using a naked light—a 'Comet' oil lamp—for the purpose, when some fire-damp, which appears to have collected below the stage, was ignited by the deceased, with the result that the stage was blown up and he fell into the sump and was drowned. It was stated that no fire-damp had ever been seen or even suspected before this occurrence, and no special provision had been made to ventilate the space between the top of the water in the sump and the stage.

Not only should all sumps be ventilated, but they should be examined by a competent person periodically, and especially before workmen are sent into them with naked lights to do any work.

The non-fatal explosions were 14 in number, and caused injury to 31 persons. Some of these would probably be more correctly described as ignitions of fire-damp than explosions, but to admit that they were not explosions within the meaning of the Act would be tantamount to saying that they need not have been reported. It is clear, however, that the intention of the legislature was to insure the smallest injury from gas being reported with the view of investigation, and it would be well in future legislation to insert the words "or ignition" in the clause requiring personal injury by explosion to be reported.

The non-fatal explosions occurred as follows:—

On the 4th January, at Varteg Colliery, Red Vein (anthracite), a collier was slightly burned by the ignition of gas at the face of his working-place, a double-road stall 18 yards wide. Two shots had been fired in succession, bringing down about 12 feet by 4 feet by 3½ feet of coal and on returning to the face with his naked light, a little gas was fired. The air-current was not conveyed sufficiently near the face.

On 6th January, at Gellyceidrim Colliery (anthracite), two men were burned by an explosion of gas while re-opening an old slant in the Black vein using naked lights. They had just reached the bottom of a small pit from an upper (Big) vein, and the gas was found to be coming from this vein. Safety lamps were put on afterwards.

On the 19th January, at Graigola Merthyr Colliery, Graigola seam, two colliers were slightly burned by gas in a narrow heading being driven through an old pillar, which had passed a small upthrow fault. No gas had been seen before, and none being suspected in such a place there was no brattice to lead the current of air to the face. Naked lights are, and I believe always have been, used in this colliery, which is only slightly fiery.

On 25th February, at Hill's Plymouth Co.'s South Duffryn Colliery, Merthyr, an explosion occurred which resulted in serious injury to one person (the fireman of the district) and slight injury to four others. A hole about 24 feet long by 15 feet wide, and over 30 feet high in the centre, caused by a fall of roof, was being timbered and lagged. It was stated that before the débris had been cleared the hole had been examined for gas to a height of 30 feet from the floor, or about 18 feet above the new timbers, and no gas was found. The men were using naked lights, the place being a double parting on the main intake 700 yards from the shaft, but 500 yards on the out-bye side of the lamp station, and while on the top of the timbers, gas was ignited by one of the lights. The fall had taken five days to clear, and there can be little doubt that, while removing the débris, and allowing the current of air to pass nearer the ordinary level of the roadway, the gas accumulated gradually in the cavity above, until it filled it down to the level of the men working on the timbers.

In such a place as this no naked light should have been allowed, and moreover, until the space above the new laggings was stowed, a current of air should have been directed over the timbers, which could easily have been done by placing a sheet or two of canvas across the roadway after sufficient space had been cleared.

Fortunately the road on each side was damp, some parts being wet, and the flame did not extend farther than about 160 feet on the out-bye side and 35 feet on the in-bye side.

On 27th February, at Tower Colliery, Hirwain, a collier was slightly burned by gas in a narrow place, rising 1 in 3, in the Two-feet-nine seam, which is worked by naked lights.

The place was ventilated by brattice, and the small quantity of gas apparently accumulated in consequence of a brattice sheet having been torn partly down when the haulier passed out with his horse and tram during the absence of the two men who worked in the place. When they returned about half-an-hour afterwards one of them stopped to repair the defect, but the other went on to the face, with the result stated.

On the 4th of April, at Nantmelyn Colliery, Aberdare, an explosion of gas occurred which burned nine persons more or less seriously. It appeared that the fireman of the Four-feet seam found some gas, where the roof was ripped near the face of a stall, while making the morning inspection in compliance with General Rule 4. He also found a defect in a door, upon which the ventilation of this place depended, and he roughly repaired the defect. He finished his inspection, and having stopped all the men and boys who were to work in this district at the double parting, he returned to the place along with a repairer to complete the repairs to the door, and get the gas removed from the stall road, if possible. Shortly after this the explosion took place. It was found that two young men, one of whom had lost light in his safety lamp, had gone through two doors near the double-parting, and while in the return airway, which at this point runs parallel with and within 20 yards of the intake, had opened one of their lamps and caused the explosion. They were both badly burned; the fireman and repairer, who were 120 yards further in and near the return, were burned and also injured by being knocked down, and five more men and boys sitting near the doors at the end of the double-parting were burned, while several others escaped.

The gas which was exploded was either that which had been discovered by the fireman, or an accumulation in an abandoned stall just beyond the return, and in a line with the doors through which the two lads passed. The latter place was a suspicious one, being partly fallen, and having pipes in it to direct a current of air on to the fall. It was, however, said that there was no gas there, and none was found upon inspection. If there was no gas in this place that which exploded had been driven out after the repairs had been made to the door by the fireman and repairer, and had not been diluted when it reached the point of ignition 200 yards outwards from the face.

The two youths who opened the lamps were prosecuted for this offence and fined.

On 6th May, at Velinfran Colliery, Llansamlet, a collier was slightly burned on entering his working place before the morning examination. No gas was said to have ever been seen in it, and none could be discovered upon inspection. Naked lights are used.

On 19th June, at Penygraig Colliery, No. 3 Rhondda seam, a collier was burned by the ignition of gas with a naked light in his working-place (a skip off the side of heading) which was adjoining a fault. A small quantity of gas had been found in the morning by the fireman, who stated that he cleared it, and gave the collier a safety lamp to work with at the face, but apparently allowed him to retain his naked light.

If it was necessary to use a safety lamp there should have been no naked light allowed in the place, or in any other on the return side of it.

On 22nd June, at Brithdir Colliery, Neath, a haulier and a collier were slightly burned near the face in the Tir-Edmund seam, which is worked with naked lights. It was alleged that the gas accumulated during the time the haulier had to wait at the face for a tram, and in consequence of a brattice sheet being removed to admit the horse to pass in, the road being rather low. On investigation, I came to the conclusion that there must have been a little lying gas before the haulier passed in.

There was certainly laxity of discipline here, in allowing a road to be worked in which a ventilating sheet had to be removed to permit the horse to reach the face, and if this was a practice it showed bad management.

On 28th August, at Ystradgynlais Colliery (anthracite), a fireman was burned under the following circumstances. A new slant was being driven from the surface to reach the Big vein. About 100 yards down it had passed through the face of some old workings in the Four-feet vein, an upper seam, and for a time these old workings served as a return to the upcast shaft where there is a ventilating fan. Further down a second opening was made, and this became the most direct return from the new slant. No gas appeared to have been seen in the old Four-feet workings near the slant, but eventually some accumulated and reached the new slant at the first or higher opening. On going down in the morning to make his inspection the fireman ignited the gas, either by a naked light or while lighting his safety lamp with a match near the place.

Care was taken afterwards to keep the old openings properly ventilated.

On 10th October, at Cross Hands Colliery (anthracite), a collier was slightly burned by igniting some gas, apparently given off after a shot in the coal, in a narrow tophole 12 feet up, rising 1 in 2, naked lights being used. The ventilation was found adequate.

On 12th October, at Newbridge Rhondda Colliery, No. 3 Rhondda seam, the under-manager and a labourer were burned in a disused stall which the under-manager was examining prior to its being stowed up. It was said that the gas had accumulated in a hole in the roof, and was ignited by the under-manager on returning, having removed the gauze from his safety lamp. Naked lights are used at this colliery.

The ventilation was found upon inspection to be adequate, and no gas could be discovered.

On the 21st December, at South Rhondda Colliery, a collier and his boy were slightly burned by the ignition of gas near the face of a stall which had been stopped at a small fault. The pillar was being worked back, and it appeared that the boy had gone beyond the point where they were working, and kindled the gas with his naked light. The seam is supposed to be the No. 3 Rhondda, and is worked with naked lights. The ventilation was found sufficient.

On 30th December, at Werfa Colliery, Aberdare, Seven-feet seam, steam coal, a collier was slightly burned on one hand by igniting gas in the upper cut of his stall which was approaching a disturbance. This occurred in the only district then worked with naked lights, and safety lamps were put on in it.

It will be seen that all these explosions or ignitions of fire-damp were of a nature only too common. Probably some of those which happened in naked light collieries might have been prevented by more attention on the part of officials to the details of ventilation, and more care on the part of the sufferers themselves; but none of them would have occurred with safety lamps, properly used; and until safety lamps are universally adopted in mines only slightly fiery small explosions will continue to happen.

Falls of Roof and Sides.

Little progress, I regret to say, has been made in the reduction of the accident and death-rate from falls of roof and sides, the most constant and prolific source of accident in mines. The number of fatal accidents was 82, and the lives lost thereby 84, against 83 and 88, respectively, in the previous year.

Falls of Roof.

Of the total number 58, or 70 per cent., were falls of roof. In two of these accidents two persons were fatally injured in each case; in each of the remaining 56 accidents one person was fatally injured, the total deaths from this cause being 60—two less than the number in the preceding year.

The investigations made into these fatalities did not disclose any unusual features. For the most part they were falls of roof at the face of the workings, generally from between slips,

joints, or cracks, the presence of which had apparently escaped observation, and consequently, where no special precautions to guard against accident by a fall had been taken. In some instances, so little had the idea of any fall occurring at the spot existed in the minds of either the workmen or such of the officials as had visited the places, that nothing at all had been done in the way of supporting the roof as a precaution against any hidden weakness. Thus, as happens year after year, a certain number of lives was lost by over-confidence in the natural strength of the roof and reliance on the skill of the miner to detect any sudden change or weakness therein.

It is frequently noticed that the spot where a serious or fatal accident has occurred is the very spot where the miners, and presumably the officials who had examined the place, deemed the safest within the working limits of the place, and on this account it had been worked under with less propping than other parts of the same working-place.

Similarly, on roadways, where the responsibility rests entirely on the management, falls sometimes occur at points where the natural strength of the roof is relied upon, and nothing whatever done to make the roof secure.

Falls of Side.

There were 24 fatal accidents, and 24 deaths resulting therefrom, being the same number of accidents, but two less deaths than in the preceding year.

Of these accidents, 21 were at the face, and three on roads.

With regard to falls of side at the face, several of them were, as in former years, the result of failure to properly fix a sufficient number of sprags. Gross negligence was disclosed in at least four cases, where the miners were holing without sprags or had allowed their boys to work in front of unspragged coal. As I have frequently mentioned in former reports, particular care requires to be taken in many of the mines in this district, owing to numerous slips or cleavages running in all directions through the seams, and the presence of beds of shale or clod overlying the seams, but not strong enough to be kept up as the roof.

There is probably nothing which the average collier is so reluctant to do as to fix sprags simply as a precaution, and to this reluctance many of the serious injuries which occur almost daily, and much of the loss of life every year, is unquestionably due.

I give below the usual table showing the number of deaths by *falls of roof* and by *falls of side*, the number which occurred at the face and on roads, and the occupations of the sufferers :—

—	By Falls of Roof.		By Falls of Side.		Total Deaths by Falls in 1893.	Total in 1892.
	At Face.	In Roads.	At Face.	In Roads.		
Colliers -	26	3	15	—	44	52
Boys of 16 and under -	7	—	5	—	12	5
Repairers, rippers, &c. -	1	11	1	1	14	15
Stowers, labourers - -	1	2	—	1	4	8
Hauliers, trammers - -	—	9	—	1	10	5
Officials - -	—	—	—	—	—	3
	35	25	21	3	84	88
	60		24			

From the above table it will be seen that a very considerable proportion of those killed by falls were boys, hauliers, labourers, and others, none of whom had any control over the securing of the roof and sides. The fatalities amongst boys working at the face is again high, the number (12) being three more than the average of the previous six years. The same remark applies in the case of hauliers, the fatalities last year being higher than in any year since 1886, and four above the average for the six years 1887–1892 inclusive.

The whole question of propping and spragging requires the consideration of owners and managers and all concerned with the view of determining what further precautions ought to be adopted to reduce, if possible, the annual loss of life. So far as my experience has led to any conclusions on the matter, one conclusion is that far too much is left to the judgment of the individual collier, who, however practical he may be in other respects, frequently errs in judgment in this respect, and the result of this is that either himself or some other person receives serious or fatal injury in the long run.

If no other person than the practical collier could possibly get killed through this error of judgment, it might be a question as to how far he should be compelled by law to protect

himself by propping regularly and closely behind the working face when and where he did not think it necessary to do so. But boys must be trained to work at the face, at any rate in thin seams, and these boys, as well as many other workers, are also exposed to much of the danger common to the collier. For this reason, if not to protect the collier against himself, it seems to me that something more requires to be done.

Better supervision on the part of the officials and a more regular enforcement of rules and regulations would do good, but the rules are defective and will have to be much strengthened before any considerable improvement in the safety of coal work at the face and on the roadways can take place.

In Shafts.

There were 11 fatal accidents resulting in the death of 21 persons, compared with 25 fatal accidents and 27 deaths in 1892.

This considerable improvement in the number of fatal accidents is encouraging, and it is to be hoped may at least be maintained. In consequence of one fatal accident causing no less than eight deaths, and another four, the number of deaths, although below those of 1892 and 1891, was still higher than any other year since 1884.

Overwinding.—There was no fatality by overwinding last year.

Ropes and Chains breaking.—No fatality.

Whilst ascending or descending by Machinery.—One fatal accident resulting in the loss of four lives occurred. This happened at the Naval Colliery, Penygraig, about 8.45 p.m. on 14th December, while an underground haulage rope was being lowered down the shaft.

The following report, which was forwarded to you soon after the accident, will suffice to explain the circumstances:—

Sir, Swansea, 27th December 1893.

I have the honour to acknowledge the receipt of your Minute, No. X. 45,333, with reference to a fatal accident at the Naval Colliery, with a newspaper extract from the "Times," for my report thereon.

The account given in the "Times" is a fairly accurate description of the circumstances attending the accident, which has been carefully investigated by me, and exhaustively inquired into at the coroner's inquest on the 21st instant. The accident appears to have been brought about by the anxiety of John Way, night overman, one of the deceased. Instead of following the usual custom in lowering a haulage rope down the shaft, he, in order to save a little time, adopted another course. The usual method was to lower the haulage rope 40 or 50 yards down the shaft and leave it there until the men engaged in the operation had descended in the cage to the landings, and then, after a signal, to lower the rope to the landings, where the men received it and dragged it along the roadway to the proper point. In this case, however, Way ordered the engineman to lower the rope down the shaft in advance of the men; and the accident occurred while he and five others were descending in the cage after the rope had been lowered about two-thirds of the total depth, which is 410 yards. The haulage rope in question had a piece of chain attached to the end hanging down the shaft, but apparently the weight of this chain was insufficient to keep the rope plumb and carry it through the iron staples fixed in the side of the shaft, at intervals of 15 to 30 yards, to keep the haulage rope in its proper position within a few inches of the shaft side. The rope being a new one and liable to twist, it coiled itself round the two nearest guide-ropes used as conductors for the cages.

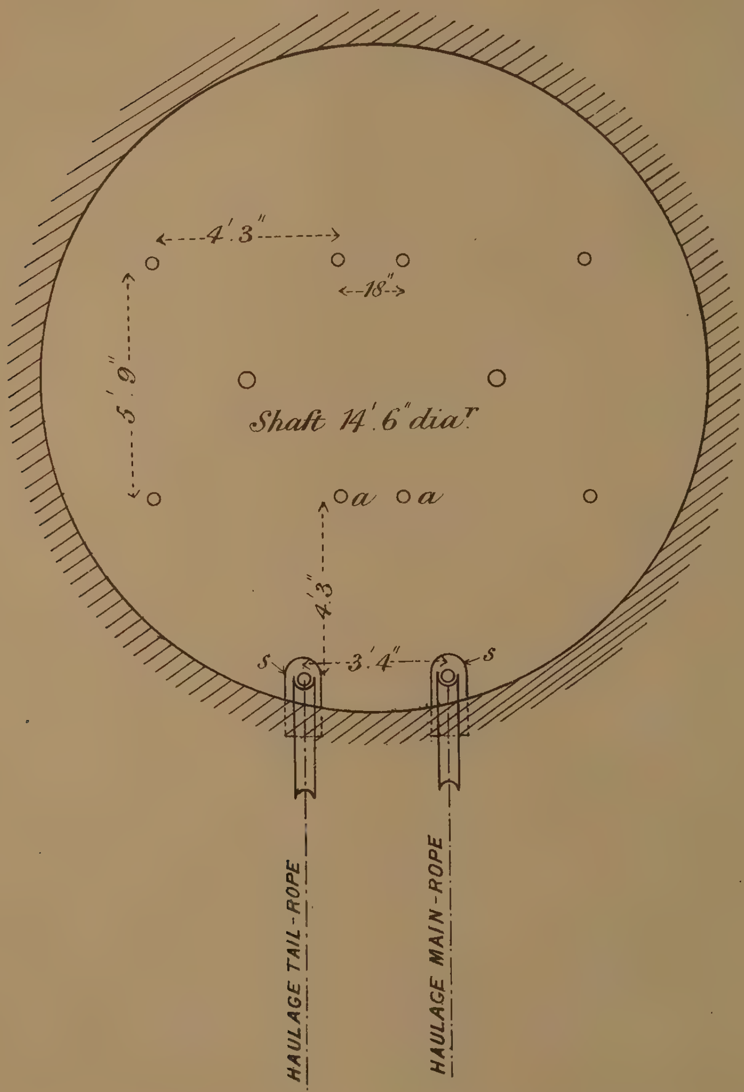
The cage containing the six men was lowered at the ordinary speed, and just before it reached mid-shaft one of them noticed that the haulage-rope was not hanging in its proper place, and immediately afterwards the cage stopped and tilted slightly to one side, with the result that three out of the six men fell out of it to the bottom and were killed. The cages had not actually collided, but owing to the slack in the rope of the descending cage and its tilted position in the shaft, Way, who was one of the three left in the cage, appears to have become alarmed lest the cage should drop, and he determined to attempt to reach the nearest landing in the shaft below by sliding down one of the guide-ropes, but in this attempt, which was a most reckless one considering the distance, he failed and lost his life thereby.

In all probability the three persons who fell out of the cage had not had a proper hold of the bar fixed on the side for that purpose. The two who were saved say they themselves had hold of the bar, but that at least one of the deceased had not hold.

PLAN No. 3.

NAVAL COLLIERY PANDY PIT.

Plan showing position of Winding and Haulage Ropes and Wire rope Guides in Shaft where a Fatal Accident occurred on 14th December 1893 causing the Loss of Four Lives.

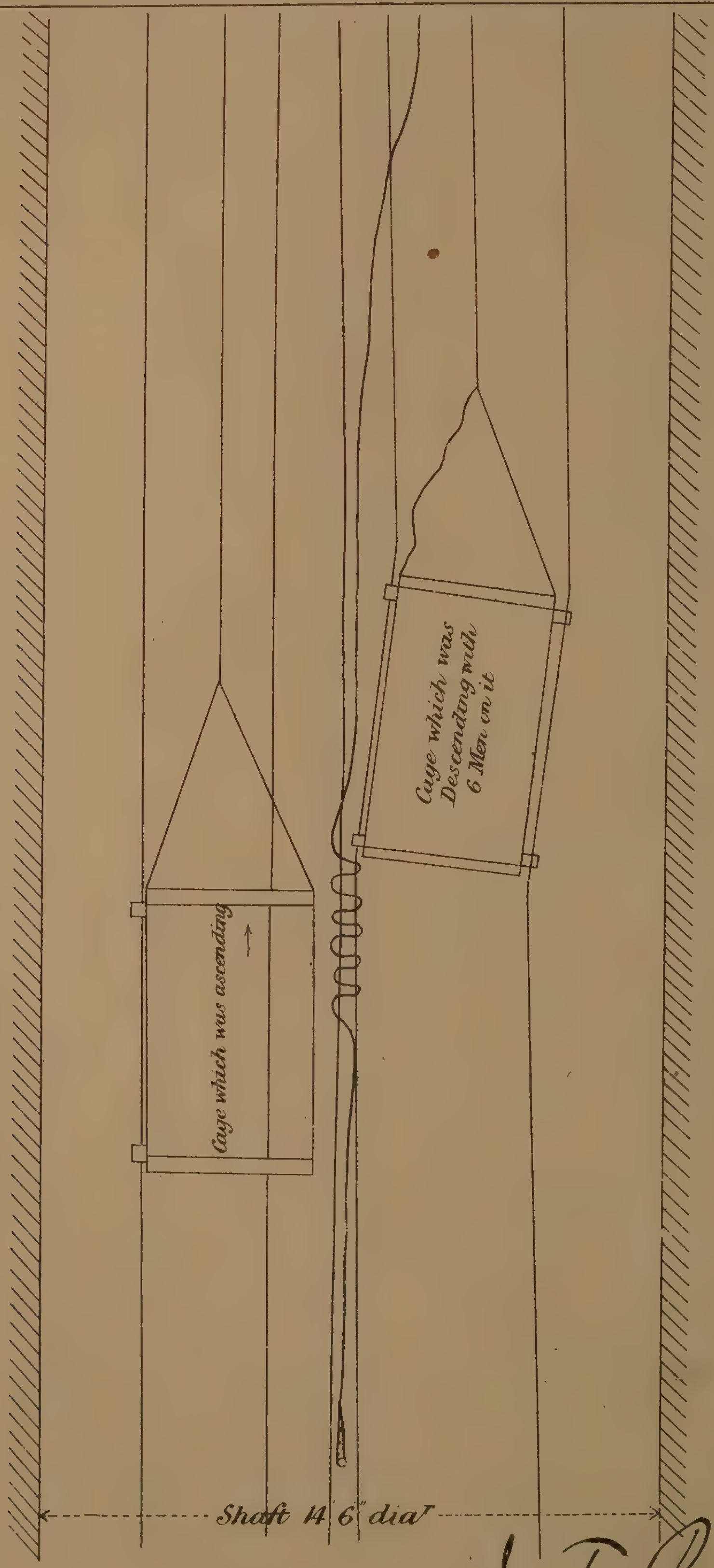


Guide ropes, round which Haulage main rope coiled, marked a.a.
Staples, marked s.s., to keep Haulage ropes in position in Shaft.

J. T. Robson,
Inspector of Mines.

NAVAL COLLIERY, PANDY PIT.

Side view of Shaft showing Winding & Haulage ropes, wire rope guides & cages where a Fatal Accident occurred on 14th December 1893, causing the Loss of Four Lives.



J. T. Robson.

Inspector of Mines.

The arrangements at the colliery are similar to those at many other collieries. There was no rule or regulation infringed, and I do not think that the management can be blamed for the sad occurrence.

Had the cages been provided with a fence at each end, probably three lives would have been saved in this case. There appears, however, to be a certain amount of prejudice against the fencing in of men while ascending or descending in a cage; at all events there are very few instances where this method has been introduced. In my opinion, there is greater danger of falling out of a cage where wire rope guides are in use than where rigid iron or wooden guides are used as conductors, because of the greater liability for the cages to tilt when anything catches them. Still wire rope guides have advantages over others, and where men in descending or ascending exercise proper care in holding on to the bars there is very little danger of falling out.

I enclose herewith a plan and a side view of a portion of the shaft to illustrate this accident.

I have, &c.
(Signed) J. T. ROBSON,
Inspector of Mines.

The Right Hon. the Secretary of State,
Home Department,
&c. &c. &c.

Falling into Shaft from Surface:—One fatal accident, and one life was lost by this cause. It occurred at the Dowlais Iron Company's North Tunnel pit on 15th May to a boy aged 14 years employed as a mason's labourer, where a new ventilating fan was being erected near the top of the shaft, which was still being used as a furnace upcast. A wall had been built round the shaft to the required height, a rectangular framing of timber with one centre beam fixed on top of the walling, and on each side of the centre beam two loose planks were laid, forming together a stage across the shaft 5 feet wide. The space on each side of this stage was left open. Deceased was permitted to wheel a barrow with materials for the masons across the stage, and had done so during several days before that on which the fatality occurred. Towards evening on the day of the accident deceased was wheeling his barrow loaded with stones across the shaft during a thunderstorm, and fell through one of the openings down the shaft, a depth of 251 yards.

It would have been an easy matter to have avoided such an unfortunate fatality as this by providing a passage outside of the shaft for the conveyance of the builders' materials, or the stage and the two open divisions of the shaft could easily have been fenced, but neither of these simple precautions was taken.

By your instructions proceedings were instituted against the responsible persons for contravention of the 19th General Rule, but the case was dismissed by the magistrates, apparently on the ground that in lieu of the fencing round the shaft that had previously been provided, but removed "for the purpose of repairs or other operations," there was the stage five feet wide across the shaft, which on the evidence they held was a "proper precaution."

It is much to be hoped that this decision will not have the effect of making managers and others less careful in the temporary removal of shaft fences and the provision of proper precautions where such removals are unavoidable.

Things falling from Surface.—One death occurred from this cause. At Abergorky Colliery, a collier, while placing a mandril on a loaded tram in the cage, was struck on the head and killed by a piece of coal falling from the cage at the surface down the shaft.

The piling up of trams so much in vogue in this district is the cause of continual falls of coal down the shafts, and every year there is some loss of life. In 1892, two hitchers and one haulier were killed in this manner.

Falling from part way down.—Two separate fatal accidents, and two lives were lost. The first was at Bwllfa Colliery, Aberdare, where a night labourer apparently wandered into the return airway, got over or through a substantial fence, and fell down the upcast shaft from the Gorllwyn seam, a depth of 180 yards. This shaft was about 500 yards distant from the point on the main working road where he had been sent to work, and no reason could be discovered for his going so far out of his way. The return airway was not a road to be used except in emergency.

In the second case a master haulier at the National Colliery went into a staple pit to adjust the cages which had become jammed at meetings, probably in consequence of the empty tram not being secured in the cage by the "catches," and in so doing slipped off the cage along with the empty tram.

Things falling from part way down caused three fatal accidents and the loss of 10 lives. In two of these cases pieces of coal or stone, probably from ascending cages, struck the deceased at the bottom of the shaft with fatal results. In one of the above the sufferer was a hitcher who was in the act of crossing the open shaft bottom while the cages were running, although there was a safe passage within four yards of the shaft.

The third fatality was that at the Dowlais Iron Company's new winning at Aberdare Junction, by which seven persons were killed and two injured, one of whom died from the injuries soon afterwards. The following report will explain the circumstances under which this unfortunate accident occurred :—

SIR, Swansea, 11th February 1893.

WITH further reference to the accident which occurred at the Dowlais Iron Company's new sinking on the 23rd January, by which seven men lost their lives and two others were injured, I have the honour to report that I attended the adjourned inquest on the 9th instant, and from my examination of the shaft on the day following the occurrence, and the evidence given, I came to the conclusion that this sad fatal accident was the result of misplaced confidence in the security of the natural strata sunk through on the part of the agent, Mr. H. W. Martin, Mr. Daniel Lewis, the certificated manager, and Mr. William Jones, the master sinker, especially the two latter, as they had both been in the shaft on the day of the accident, and were more directly responsible for the safety of the sinkers employed.

It may be here noted that the master sinker was an experienced man in such operations, but the manager had had no experience in actual sinking prior to his taking charge of this sinking about 24th December 1891. The work was being done on shift wages, paid directly by the company, there being no contractor.

The shaft is being sunk fully 22 feet diameter, which leaves it 20 feet diameter where it is walled, the walling being a foot thick. The large diameter exposes a surface of 70 feet round the shaft. The practice is to sink so many yards, then stop sinking and put in, a walling curb within a few yards of the bottom, and wall up to the last curb put in when sinking is resumed. The distance sunk before a length of walling is put in is decided from time to time by those in authority, and varies according to the kind of strata passed through, the sides being examined daily by the leader of the shift, and a special examination being made once a week. As many as 35 yards have been sunk before a length of walling was put in. The total depth on the day of the accident was about 268 yards, 249 of which had been walled, and sinking was being proceeded with at a depth of fully 19 yards below the last walling, the strata passed through being as follows :—

	yds.	ft.	in.
Rock - - - - -	6	1	6
Clift - - - - -	1	0	0
Rock - - - - -	12	0	0

It was a portion of the rock immediately above the clift which fell; and probably the fall was caused by the clift having softened and fallen out previously, although this was not admitted by witnesses at the inquest. Clift is a kind of shale which is liable to soften with exposure, and especially where wet, as in sinking. In my opinion, it would have been a wise precaution to have secured this bed of clift by cribs round the whole circumference, whereas all that had been done was to secure it in two places where undoubtedly portions of the clift had fallen off or had been pulled off previous to the accident. Then, as soon as the rock below the clift was sunk into, say three or four yards, it would have been a proper course to put in a length of walling instead of continuing so far below the clift.

I beg to say that no provision of the Mines Act or special rules appears to have been violated.

I enclose notes of the evidence at the inquest, and a sketch showing the shaft where the stone fell from.

I have, &c.
(Signed) J. T. ROBSON,
Inspector of Mines.

The Right Hon. the Secretary of State,
Home Department,
&c., &c., &c.

Miscellaneous in Shafts.—Three fatal accidents and three deaths are thus classified.

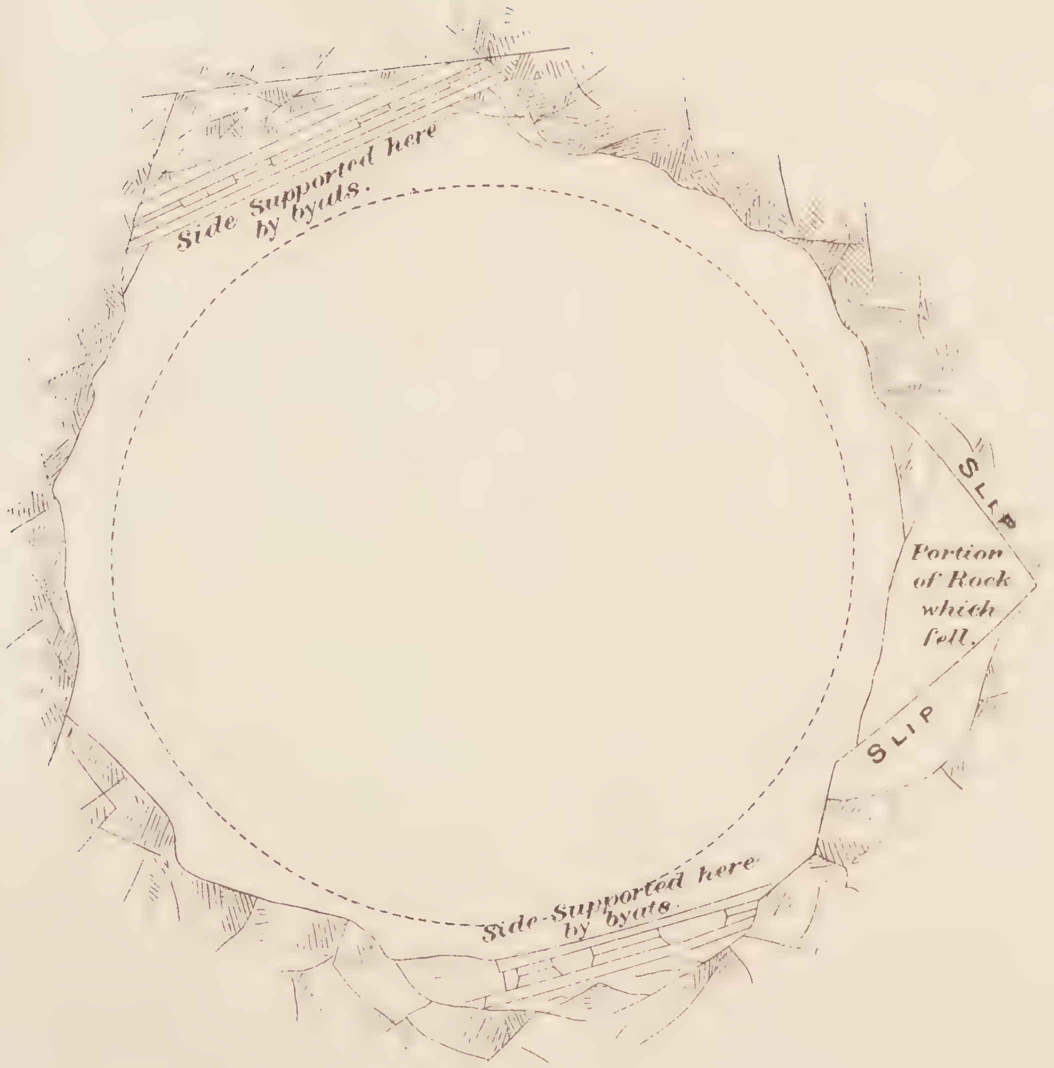
Two of these occurred at the same colliery, the No. 3 Ferndale (Bodringallt). In the first case a repairer attempted to get on the cage after it had been signalled away by the hitcher, and having failed to secure a proper footing and a hold of the bar, was crushed between the cage and the beams near the top of the archway, or mouthing, and killed. The

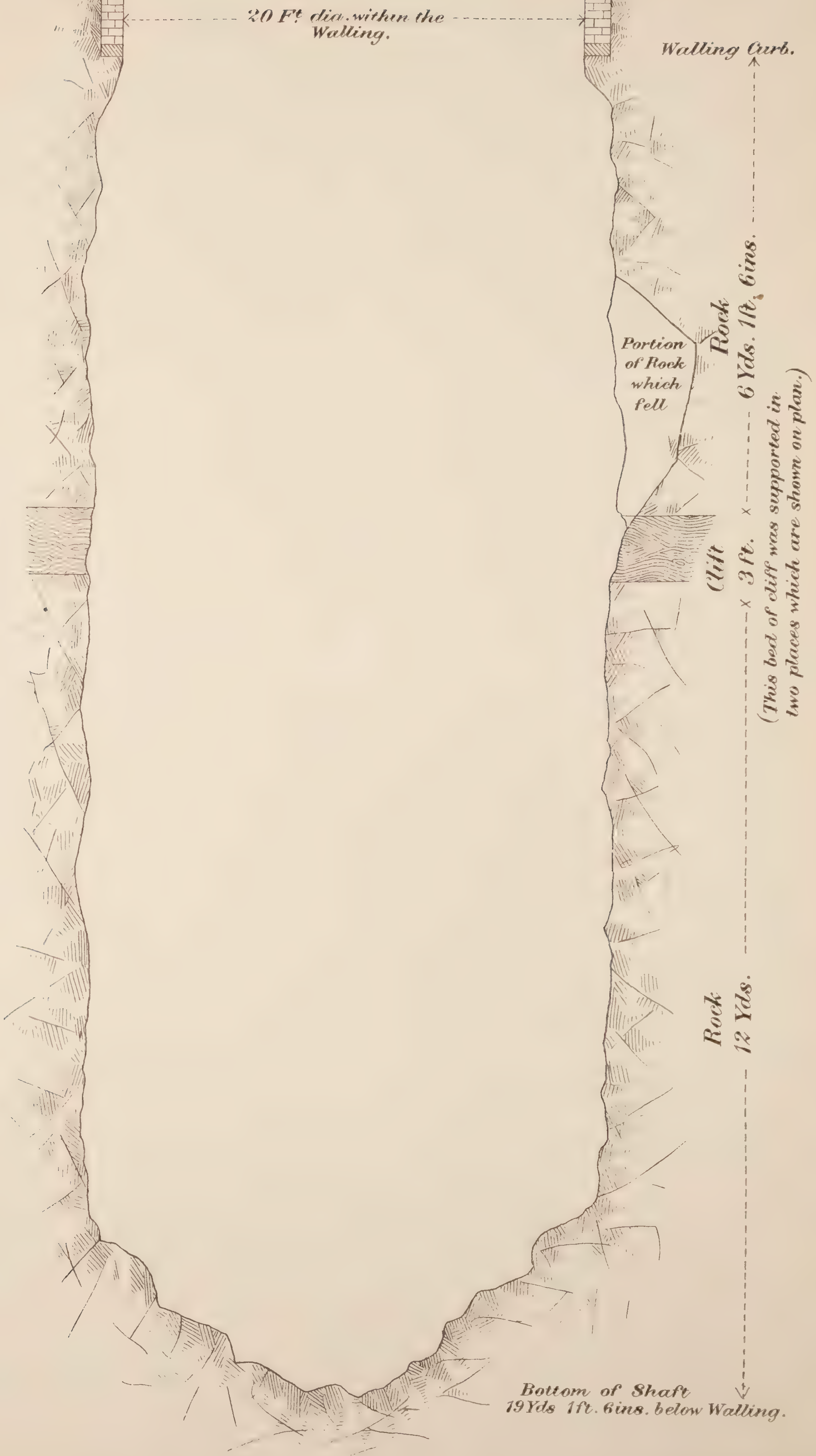
Plan and Section of Dowlais Sinking Shaft

Showing where a Fatal Accident occurred on 23rd. Jan. 1893.

causing the Loss of 8 Lives.

Scale – about Six Feet to One Inch.





J. T. Robson

Inspector of Mines

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cage had been signalled away before, and then stopped by signal to allow another man to enter it, and it appeared probable that deceased had been misled in this, thinking the last signal made, just as he arrived, was a signal to stop the cage for him. Such signalling and stopping is apt to lead to misunderstandings, and thus to accidents, and should not be practised.

In the second case the deceased, a labourer, was assisting the hitcher to remove a tram from the cage when the cage was raised, and he was crushed against the beams and killed. The banksman had given the signal to the engineman to move the cage before ascertaining that it was safe to do so, his excuse being that while away for a few minutes from the top of the shaft he *thought* he heard a signal from the bottom, but the evidence that any such signal was given was against him. He should certainly have ascertained beyond doubt, by having the signal repeated, that it was safe to do so before ordering the engineman to raise the cage from the bottom.

The third case was that of an assistant hitcher, at No. 2 Pit, Great Western colliery, who, while attempting to cross the open shaft bottom, during winding operations, was crushed by the descending cage. The road from one side of the shaft to the other was in this case about 20 yards back.

MISCELLANEOUS UNDERGROUND.

Explosions of Gunpowder, &c.—One fatality occurred by this cause. At the Rivel Level colliery, Aberdare, two brothers, both experienced colliers, went into their stall, which had been fenced off the previous day in consequence of a "missed" shot, and began to unram the charge. In doing so, it exploded, injuring them both, the younger one so severely that he died the following day. Two rules were deliberately violated by these men, first in entering the place while it was fenced off, and secondly, in unramming the charge.

Besides the above 21 non-fatal accidents occurred during the year in connexion with explosives, causing injury, in many cases of a very serious nature, to 26 persons. These occurred as follows :—

On 25th January, at Penrhiwfer Colliery, Caerlan drift, a collier (31) was injured on the face by the explosion of a shot of gelatine-dynamite. It appeared that he had charged two holes, lighted them, and retired a distance of 30 yards. One shot went off and apparently, in the belief that both had gone off together, he returned, when the second shot exploded upon him. He said there was a difference of six inches in the length of the fuse. This was a clear case of returning too soon.

On 23rd February, at Wernganol level, two men, one 40, and the other 28 years of age, employed in driving a hard heading, were injured while tempering some dynamite cartridges by placing them on a shovel, and then on a fire, at the surface.

On the 7th March at Mardy Colliery, an experienced stoneman (57) was injured by the explosion of a shot of compressed powder while ramming the charge, using a wooden rammer. It appeared that the hole had been bored by hand drills. This was against the published instructions of the manager, which permits the use of compressed powder only in machine-drilled holes, and, moreover, was done within the knowledge of the fireman of the district, who was discharged for failing to call attention to the breach of orders.

On the 22nd March at Fforchaman Colliery, two colliers, each 18 years of age, were injured by the explosion of a shot which had missed fire six days before. A shot had been fired subsequently to the missed shot, and in removing the débris one of the men struck the powder with his pick and caused the explosion.

On 13th April at Cymmer Colliery (steam coal), a hard heading man (34) was severely injured while attempting to unram a charge of carbonite which had missed fire. Electric firing.

On 26th April at Abercanaid Colliery, a collier boy (14) was burned on face and severely injured on the hands by the explosion of a detonator at the lamp station. It did not transpire how the detonator got into the boy's possession, but some were kept in a lock-up cabin adjoining the lamp station.

On 27th April at Ynyshir House Coal Colliery, a repairer (35), while charging a hole drilled in stone with hand drills, used a drill to push in one of the pellets which had stuck in the hole, with the result that the powder exploded and injured him severely.

On 11th May, at Abercanaid, a surface haulier had three fingers of left hand and thumb of right hand blown off by an explosion on the surface. He said it was a "cap" (detonator) which was on the ground where he was passing and that either the horse he was driving or himself had trodden on it, but this could not have been the case. He must have had it in his hands, and was probably pricking it with something sharp when it exploded.

In eight more cases the deceased were run over or struck by trams on engine-planes, one of the deceased being the manager of a colliery.

The remaining fatality was on a short incline worked by a windlass. In lowering a loaded tram, the handle of the windlass came off and deceased, who was in front of the tram, drawing it over, was carried down by the tram, the man at the handle having failed to stop it by the brake.

In two of the cases referred to above, the accidents were at least indirectly caused by breakages; in one case at Glyn Colliery, the hitching-plate of the first tram of a journey on an incline dipping from 18 to 34 inches per yard, and in the other, at Cefn Colliery by the breaking of the haulage-rope, which was found to have been in bad condition.

By Trams and Tubs.—14 separate fatal accidents, and 15 lives were lost by trams and tubs on roads other than inclines and engine-planes.

Five of the above fatal accidents occurred to hauliers; one to an assistant-haulier or door-boy, two to shacklers, three to colliers, and four to labourers.

In two of the cases amongst hauliers, the deceased may have fallen off trams while riding, but this could not be proved. In several of the cases, there had been a certain amount of carelessness, while others were such as may happen occasionally, even with careful persons.

By Machinery Underground.—None.

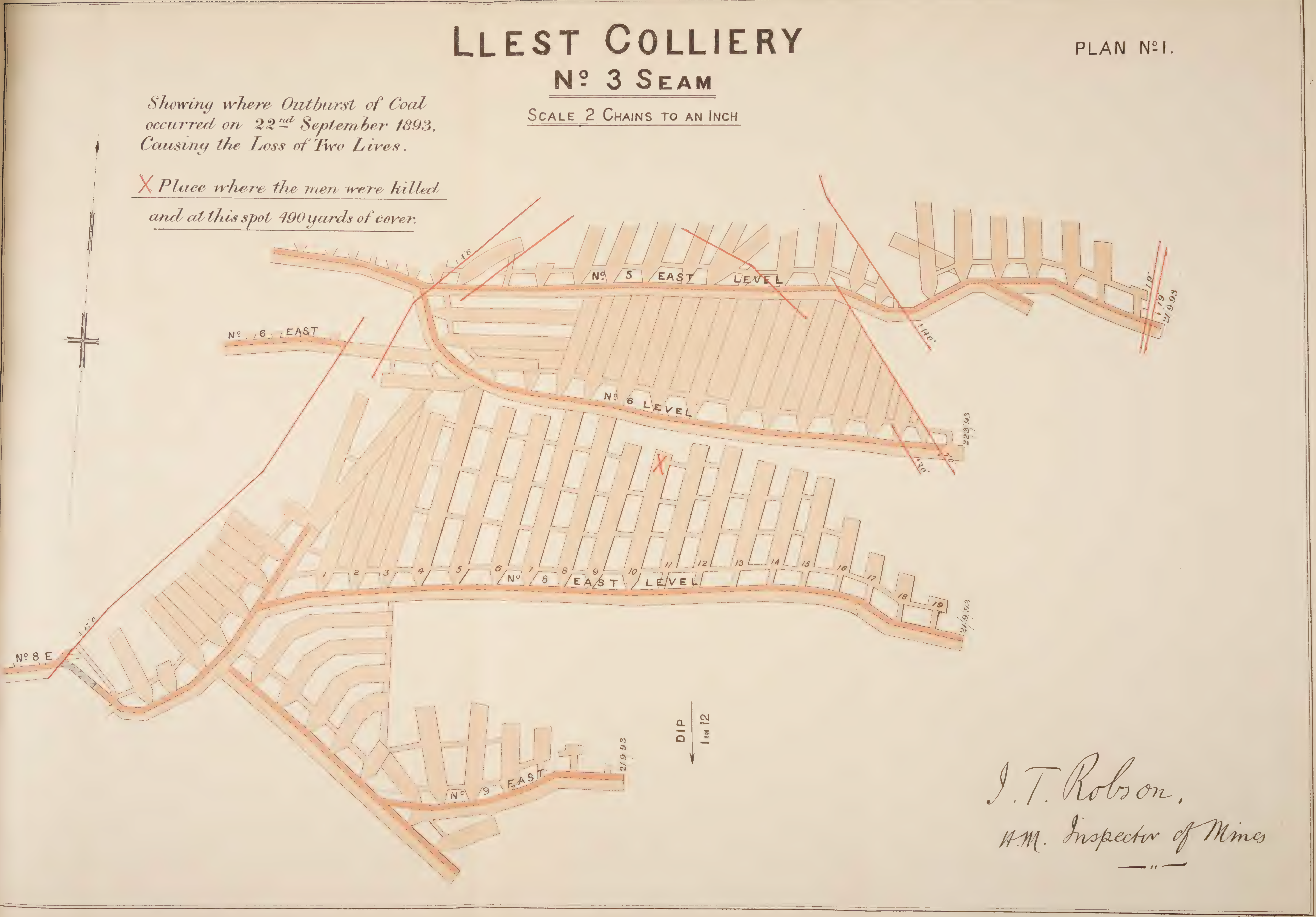
Sundries Underground.—Three fatal accidents occurred which are classified under this heading, and by these 66 lives were lost.

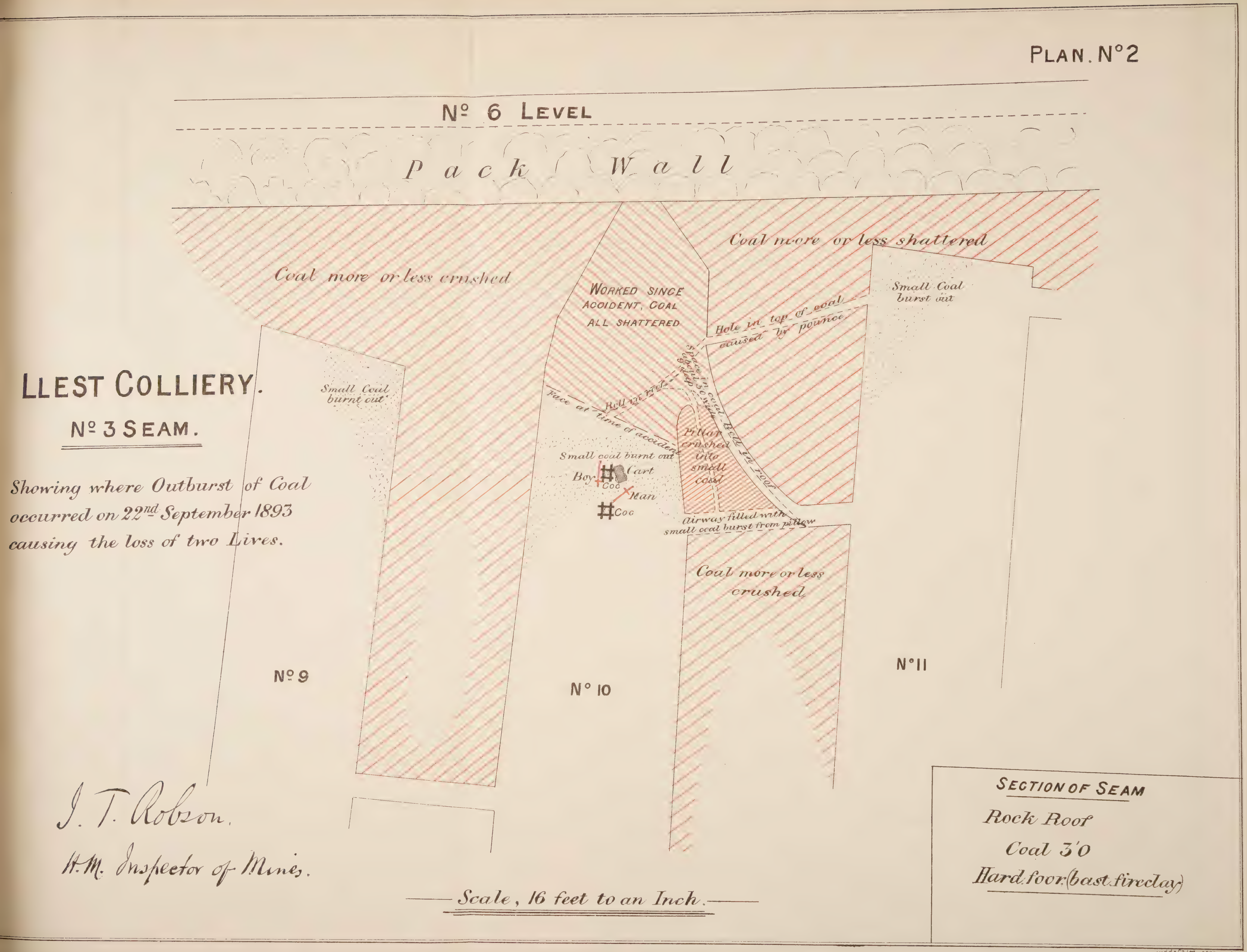
One of these accidents was the terrible disaster by an underground fire at the Great Western Colliery on 11th April, by which no less than 63 men and boys lost their lives. This accident formed the subject of special reports, after the exhaustive inquiry as to its cause, by the counsel representing the Home Office and myself, both of which reports were printed and published many months ago, and it does not appear necessary to deal with it again in this report.

This unfortunate calamity has drawn attention to a danger which exists in most of the large collieries, and I am glad to say that greater precautions against fire have now been taken in many of the collieries in this district. Much can be done for safety by reducing the quantity of timber used in and about engines, in keeping away all combustible matter such as canvas, platforms of deals, and accumulations of dirty cotton-waste and grease. By placing all engines in an arched gallery, which should extend some distance both inside and outside of the engine, much greater security would be afforded.

The question of supplying water to cope with a fire is also an important one, and cannot in the face of recent experience be ignored. In many of the mines in the district water is laid on already, at least along all the principal haulage roads, passing most of the engines on the way. But there is much combustible matter in all mines apart from engines. Indeed, it would be almost impossible to provide against every contingency which might arise and cause a disastrous fire in a mine; yet in a matter of this kind, although beset with difficulties, no reasonable precaution should be neglected.

A most unusual fatal accident occurred at the Llest Colliery, Garw Valley, on 22nd September, by which two lives were lost. This was caused by a tremendous "pounce" at the face of the workings, bursting out the coal within a radius of several yards, and particularly in the stall where the two deceased worked. The accompanying plans, Nos. 1 and 2, show the workings in the vicinity, which it will be seen are on the pillar and stall method. It appears that some small "pounces" had been heard previously, but nothing like this one had occurred in this colliery, or, indeed, in any in the district within my knowledge. There can be little doubt that it was due to the existence of a strong and thick overlying stratum of rock, which, under the system of working, did not settle gradually or at short intervals as in long-wall working, but only after a long interval and then in a large body. About 61 per cent. of the coal was being extracted in the first working, and a reference to No. 1 plan will show that the faces of the stalls had almost reached a level marked No. 6 level, in which the pillars of coal had been worked away. It is probable that the strata immediately above this upper range had not up to that moment subsided sufficiently to take its weight off the intervening strip of coal. The effect of the sudden subsidence causing the "pounce" was probably intensified by the existence of a "roll" in the roof which usually alters the coal, making it more friable. Up to that date the coal in the stalls affected was in its usual condition, which was strong and compact; the roll referred to was only discovered afterwards, when it was found that the coal near the top of the seam had been blown out from the solid pillar for several yards in length and the remaining portion all shattered.


LLEST COLLIERY
No 3 SEAM
SCALE 2 CHAINS TO AN INCH
PLAN No 1.
Showing where Outburst of Coal occurred on 22nd September 1893, Causing the Loss of Two Lives.
X Place where the men were killed
and at this spot 490 yards of cover.
No 5 EAST LEVEL
No 6 EAST
No 6 LEVEL
No 8 EAST LEVEL
No 8 E
No 9 EAST
DIP 1 in 12
21/9/93
22/9/93
J. T. Robson,
H.M. Inspector of Mines


PLAN. No 2
No 6 LEVEL
Pack Wall
Coal more or less crushed
Coal more or less shattered
WORKED SINCE ACCIDENT, COAL ALL SHATTERED
Small Coal burst out
Hole in top of coal caused by pounce
LLEST COLLIERY.
No 3 SEAM.
Small Coal burnt out
Space in coal about 3'0 wide 9" deep
Roll in roof
Face at time of accident
Pillar crushed into small coal
Roll in roof
Small coal burnt out
Boy
Cart
Coc
Man
Coc
Showing where Outburst of Coal occurred on 22nd September 1893 causing the loss of two Lives.
Airway filled with small coal burst from pillow
Coal more or less crushed
No 9
No 10
No 11
J. T. Robson.
H.M. Inspector of Mines.
SECTION OF SEAM
Rock Roof
Coal 3'0
Hard foor (bast fireclay)
Scale, 16 feet to an Inch.
Judd & Co Ltd 3589.1.1894

The depth at the place being as much as 490 yards, it is not a matter for wonder that the great superincumbent pressure became too much for the pillars and that a general settling of the rock roof took place. The pillars are now being made larger, and it is hoped that this will prevent a recurrence of an outburst of coal from the solid face.

The seam is not one which ordinarily gives off fire-damp to any appreciable extent, and has always been worked with naked lights. Gas, however, came off simultaneously with the outburst of coal, but all the naked lights in the vicinity were extinguished by the rush of wind, and from my examination of the workings on the following day, and the evidence at the inquest, I think no explosion occurred. There was evidence that the deceased had both been seriously injured by force, and probably they were killed by the blow from the coal flying off the coal face.

ON SURFACE.

By Machinery on Surface.—Two fatal accidents and two deaths occurred by machinery on the surface.

One was at Harris' Navigation Colliery, and happened to an engineman attending the air-compressing engines. Deceased was found lying dead below the crank, and had evidently been killed by it. The machinery was fenced. It was stated at the inquest that deceased had been cautioned by his fellow workmen against his habit of crossing under the connecting rod while the machinery was in motion.

The other fatality occurred at South Tunnel Colliery, Dowlais, to a pit carpenter while doing some repairs to the guides in which the fencing at the pit top worked. He leant with his head over a byatt to drive a bolt out, when the beam of the pumping engine came down and crushed him to death. An accident of this nature should not have occurred, as all he had to do was to ask the engineman to stop the engine for a minute or two, when the bolt could have been driven out with safety.

Boilers Bursting.—No fatality occurred during the past year by boilers bursting.

Railway Sidings at the Mine.—There were no less than 10 fatal accidents, causing 10 deaths, in connexion with wagons on sidings. This is a large number, and far above the average. None of them were of an unusual nature, and nearly all might have been prevented by greater care on the part of the sufferers themselves. In some cases too little space is provided between the rails and retaining walls on one side and the screen uprights on the other, and where practicable such places should be altered so as to afford more space and greater safety to wagon shifters and road cleaners.

Miscellaneous on Surface.—Seven separate fatal accidents occurred, resulting in the death of eight persons. Although less than in 1892 these figures are still high.

Four of the above accidents and five deaths were by trams. In one case only did anything break and cause the accident. This was at the Great Western Colliery, where a hitching-plate of a tram broke while a "journey" of trams was being drawn up the rubbish-tip incline. Five trams ran wild to the bottom, where a gang of platelayers were at work, with the result that two of them were fatally and three slightly injured. The bottom of this incline is situated in an archway underneath a public railway, and the unfortunate men could not see the trams until they were close upon them.

None of the other accidents call for special remarks.

PROSECUTIONS.

At Ystradgynlais, on 30th January, the owners and agent of Gwaun Clawdd Colliery, Breconshire, were charged with contraventions of the 1st General Rule (defective ventilation), the 8th General Rule and 99th Special Rules (using naked lights instead of safety lamps), and the 34th section (plan of workings not being made up to within three months of date). They pleaded guilty, and were each fined 3*l.* and costs for each of the three contraventions, a total of 18*l.* and costs.

On 28th March, at Merthyr, the manager of the Merthyr Vale Colliery was charged with not having enforced General Rule 39, section 49. A boy aged 17 years had been killed while working with another person in a stall as colliers, neither of whom appeared, on the evidence at the inquest, to have had the necessary "two years' experience of such work under the supervision of skilled workmen," or had "been previously employed in or about the face of the workings of a mine." On the case being tried the court decided to dismiss the summons, because there was no direct proof that the boy had not had two years' experience in working at the face. This want of proof was due to the fact of the boy's brother declaring that he did not know what his brother had been doing, notwithstanding that he had

previously stated differently. This point, however, was not taken up by the defendant's solicitor, but the court considered it was the duty of the prosecution to prove the facts in the summons.

At Neath, on the 7th April, the owners of the Lower Resolven Colliery were charged with the contravention of the 33rd section (failing to send to the inspector of the district the annual return), and were convicted and fined 1*l.* and costs.

At the same court and time, the owner of the Tydraw Colliery, was charged with the contravention of the 33rd section, the 34th section (plan of workings not made up), General Rule 4 of 49th section (no report book provided), and section 57 (2) (no abstract of Act or Special Rules posted up at the mine), and was convicted and fined 10*s.* for each offence.

At the same court and time the owner of the Tydraw Geilymarch Colliery was charged with the contravention of the 33rd section, General Rule 4, of section 49, and section 57, and was convicted and fined 10*s.* for each offence.

On the 26th June, at Merthyr, the agent and manager of the South Tunnel Colliery were charged with contravention of 19th General Rule. Cases dismissed.

On the 25th August, at Pontardawe, the agent and manager of Primrose Colliery were charged with the contravention of section 35 (1) in failing to send to inspector notice of an explosion of gas causing personal injury. They were convicted; the agent being fined 1*l.* and costs, and the manager 4*l.* and costs, a total of 8*l.* 12*s.*

The following prosecutions undertaken by owners and managers were reported to me under terms of section 66 of the Act.

Aberdare Colliery: Aberdare Works and Collieries Company.

28th March, at Aberdare, a collier for contravention of General Rule 12; withdrawing a charge of explosive which had missed fire. Fined 30*s.* and costs.

18th April, at Aberdare, two colliers for having unlocked safety lamps in their possession in the mine. Breach of 224th Special Rule. Each fined 40*s.* and costs.

Albion Colliery: Albion Steam Coal Company, Ltd.

27th December, at Pontypridd, a door-boy, for breach of 264th Special Rules; riding on trams. Fined 5*s.*

Avon Colliery: Sir D. Gooch, Bart., and Others.

28th February, at Bridgend, an underground labourer, for breach of 222nd and 223rd Special Rules; having a safety lamp in a dangerous condition and not returning with it to "lamp station." Fined 2*l.*, including costs.

On the same day a collier, for breach of 221st Special Rule; damaging his safety lamp with a mandril. Fined 2*l.*, including costs.

18th March, an underground labourer, for breach of 260th Special Rule; sleeping in the mine with a lighted safety lamp in his possession. Fined 2*l.*, and 18*s.* costs.

29th April, a haulier, for breach of 261st Special Rule; failing to close a ventilating door after him. Fined 2*l.*

21st October, an underground labourer, for breach of 260th Special Rule; sleeping in the mine with a lighted safety lamp in his possession. Fined 2*l.*, and 1*l.* costs, with alternative of 28 days imprisonment, which he elected to take.

28th October, a collier, for breach of 197th Special Rule, passed beyond a danger mark. Fined 2*l.*, and 15*s.* 6*d.* costs.

Avon Rhondda: Avon Rhondda Colliery Company.

7th April, at Neath, a stoker, for breach of 130th Special Rule; absenting himself from work without leave. Fined 10*s.* 6*d.*

Cyfarthfa: Crawshay Brothers, Ltd.

5th June, at Merthyr, a collier, for breach of 22nd General Rule; neglecting to sprag an overhanging slip of coal. Fined 10*s.* and 15*s.* costs.

Cymmer: Cymmer Colliery Company.

8th June, at Cymmer, a stoneman, for contravention of 12th General Rule; unramming a charge of explosives which had missed fire. No fine imposed as he had suffered the loss of his right arm.

Dunraven Colliery: F. R. Crawshay.

17th April, at Ystrad, Rhondda, a collier, for breach of 267th and 268th Special Rules; having a tobacco pipe and a contrivance for opening safety lamps in his possession in the mine. Fined 2*l.*, and costs.

Ferndale: D. Davis and Sons, Ltd.

21st June, at Pontypridd, a haulier, for breach of 187th Special Rule; cruelty to a horse. Fined 2*l.*, including costs.

On the same day, another haulier for the same offence. Fined 15*s.*, including costs.

Gadlys: Waynes Merthyr Company, Ltd.

18th April, at Aberdare, a collier, for breach of 12th General Rule; taking powder into mine otherwise than in cartridges. Fined 1*l.*

25th April, three colliers, for the same offence. Each fined 10*s.*

20th June, a helper, for breach of 266th Special Rule. Fined 10*s.*

Glyn Colliery: Glyn Colliery Company, Ltd.

15th June, at Cymmer, three colliers, for breach of 259th Special Rule; riding on journey of trams on engine-plane. Fined 1*l.* each.

Great Mountain: Great Mountain Anthracite Colliery Company, Ltd.

15th February, at Llanelly, three colliers, for breach of 100th Special Rule; having tobacco pipes and matches in their possession in the mine. Each fined 1*l.*, and 18*s.* 6*d.* costs.

Nantmelyn Colliery: Aberdare Merthyr Collieries Company, Ltd.

20th June, at Aberdare, two colliers, for opening their safety lamps, and causing an explosion. Each fined 2*l.* and costs.

Lewis Merthyr: Lewis Merthyr Coal Company, Ltd.

10th August, at Cymmer, a lamp locker, for breach of 266th Special Rule; having a tobacco pipe in his possession in the mine. Fined 1*l.*

2nd October, at Ystrad, Rhondda, a labourer, for breach of 266th and 268th Special Rules; having in his possession a tobacco pipe, scissors, lamp burner, and wick. Sentenced to two months' imprisonment with hard labour.

5th October, at Cymmer, a collier and a labourer, for breach of 268th Special Rule; unlocking their safety lamps with a nail, and their lamps being found unlocked in the workings. Fined 1*l.* each.

National Colliery: United National Collieries, Ltd.

6th April, at Cymmer, an assistant timberman, for breach of 264th Special Rule; riding between trams on a journey. Fined 1*l.*, including costs.

26th October, a collier, for contravention of 267th Special Rule; having a tobacco pipe in his possession inside the lamp station. Fined 10*s.* and 7*s.* costs.

At the same time and place, another collier, for the same offence. Case dismissed.

North's Navigation Collieries (1889), *Ltd.*

18th March, at Bridgend, a collier, for breach of General Rule 12; unramming charge of explosive which had missed fire in No. 9 Colliery. Fine 1*l.*, including costs.

22nd April, a night labourer, for breach of 267th Special Rule, having a tobacco pipe in his possession in Wyndham Colliery. Fined 1*l.*, including costs.

4th November, a collier, for breach of 22nd General Rule; neglecting to fix sprags in Tynewydd Colliery. Fined 2*l.*, including costs.

11th November, two colliers, for breach of 264th Special Rule; riding on full trams in Tynewydd Colliery. Each fined 1*l.*, including costs.

25th November, a driftman, for unlocking and opening his safety lamp, inside of lamp station, for the purpose of giving light to a haulier's lamp. Sentenced to seven days' hard labour.

At the same time the haulier for aiding and abetting the above-named driftman; sentenced to seven days' hard labour; they had also each to pay 15*s.* 6*d.* costs.

16th December, a collier, for breach of 22nd General Rule, and 201st Special Rule; not setting sprags in his working place. Fined 2*l.* and costs.

Seven Sisters Colliery: Evans and Bevan.

21st July, at Neath, a shotman, for breach of 12th General Rule, allowing a shot to be fired without first examining the place. Fined 10*s*., and 18*s*. costs.

United Anthracite Collieries, Ltd.

28th July, at Pontardawe, a collier, for opening his safety lamp with the handle of the same, lighting the same with a match, and a tobacco pipe being found in his stall, was sentenced to two months' imprisonment with hard labour.

Another case was reported as being prosecuted under the Cruelty to Animals Act, in which a haulier was convicted and fined 10*s*. and 7*s*. costs, for cruelty to a horse in the National Colliery.

From the above list it appears that only 17 companies or owners out of the total 240 in the district enforced rules by taking the offending parties before the magistrates. In the preceding year the number was 13. It is also worthy of notice that with few exceptions these companies are the same as in former years. Fines are inflicted privately in some cases by other companies, the fines, of course, being paid into colliery accident funds, but this method fails to secure sufficient publicity to have any deterring effect on others.

Exemptions.

The only exemption granted during the year was a temporary one at Duffryn Main new winning. This was to dispense with guides while a few men were employed in driving a communication between the two shafts and the fixing of the permanent pumps in one of them.

Abandoned Mines.

In the following cases of seams of a mine, or the whole mine, having been abandoned, plans and sections, as required by the Act, have been deposited in the Home Office during the past year.

No. 3 Rhondda seam, Tynewydd, Porth.
Ynys (a small trial slant), Llanelly.
Bigyn (coal and clay) Colliery, Llanelly.
Four Feet, Six Feet, Bute, and Five Feet seams at Gadlys Colliery, Aberdare.
Ynysarwed Colliery, near Neath.
Penlan seam, Penlan Colliery, Penclawdd.
Boddor seam, Bryncoch Colliery, Taff's Well.
Nine Feet seam, Graig pit, Gadlys, Aberdare.
Red coal seam, Cambrian Navigation, Clydach-vale. (This seam was re-opened again in 1893.)
Dinas steam coal seams, Dinas.
Caedû Colliery (Bushey seam), Llanelly.
Four Feet seam, at Brothers pit, Birchgrove.
Nine Feet seam, at Abergorky, Treorky.
Four Feet, Nine Feet, and Seven Feet seams at Rhondda Merthyr, Treherbert.
Five Feet seam at Elba Colliery, Gowerton.
No. 2 Rhondda seam, Upper Clydach, Clydach-vale.
No. 3 Rhondda seam, at Dinas Clydach, Clydach-vale.
No. 3 Rhondda and portion of Hafod seams, at Coedcae, Hafod.
Aberdylais level, near Neath.
Maesymarchog (Eighteen Feet seam) near Neath.
High Duffryn, Aberdare. (This colliery had not worked since 1875.)
Cwm-neol, Two-feet-nine, Four Feet, and Six Feet seams.
Amman Valley, Brynlloi seam, near Garnant.

Metalliferous Mines.

Little work has been carried on in the few lead mines situated in Carmarthenshire, and nothing at all in Pembrokeshire. In the latter county a trial was made to work a slate mine. In Glamorganshire two mines working stone have been added to the list of mines.

No accident was reported from any of these mines during the past year.

The number of persons employed was 162. Of these 96 were employed underground and 66 on the surface, six of the latter being females.

The minerals returned consisted of:—

Lead ore - - - - - -	$836\frac{1}{4}$ tons.
Stone (including flags and paving stones) - - -	5,127 "

INSPECTION DUTIES.

The three assistant-inspectors and myself have been fully occupied during the year in attending to the various duties of inspection. All complaints have had immediate attention, and, as always has been done, the greatest care has been taken not to create the impression that a complaint has been made, and the name of a person complaining is never divulged. Most of the complaints have been made anonymously.

All fatal accidents, explosions, and such of the non-fatal accidents as appeared to require attention have been carefully inquired into, with the view of preventing similar accidents, and ascertaining whether any person was blamable. Most of the inquests have also been attended. Altogether 990 visits of inspection were made, of which 639 were underground as well as surface inspections. Of the underground inspections 381 were of a casual nature, and in a majority of cases of inspection on account of accident portions of the mine apart from the scene of the accident were also inspected. All mines known to have been at work were visited at least once, in many cases twice or oftener, while as many as seven, eight, and eleven underground inspections were made in extreme cases.

As showing how frequent inspection may have the undesirable effect of relieving to a certain extent the responsibility of owners and managers, without providing as good a substitute, it may be observed that at inquests the question as to whether an inspector has been at the place within a few weeks or months is not infrequently asked. In a case where an inspector has made a recent inspection and not pointed out a particular defect, either because he did not observe it, or because his attention was not drawn to it, and this defect was the cause of a subsequent accident, the management might try to exonerate itself on the ground that the inspector had had the opportunity of pointing out the defect and had not done so.

In civil actions arising out of accidents inspectors of mines should not, I think, be called upon to give evidence, either on one side or the other. It is apt to place them in an invidious position, which should be avoided in the interests of the service. Inspectors are prohibited by the Mines Acts from practising as mining engineers, and it appears to me they should be equally prohibited from giving expert evidence in cases except those brought on under the Mines Acts.

I enclose the usual formal reports of the three assistant inspectors in compliance with the requirements of the Metalliferous Mines Regulation Act, 1872.

I have, &c.

(Signed) J. T. ROBSON.

The Right Hon. H. H. Asquith, Q.C., M.P.,
Her Majesty's Principal Secretary of State,
Home Department, Whitehall, London.

LIST of the FATAL ACCIDENTS and DEATHS arising therefrom, within one year and a day from the date of the ACCIDENT, in the SOUTH WALES DISTRICT during the year 1893.

No. of Accidents.	Date and Hour of the Accident.	Hour of the Person's Shift, i.e., Number of Hours he had been at Work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous underground.	Above-ground.	Total.
					COUNTY OF BRECON—(PART OF).										
1	1893. Aug. 9 4.30 p.m.	9th	Torfole	Penderyn	N. B. Allen & Co.	John Williams	—	Miner	Fall of roof at face, while he and his partner were boring a hole to blast a piece of side off. Silica sand level.	–	1	–	–	–	1
2	Jan. 30 10.30a.m.	4th	Yniscedwyn	Ystradgynlais	Yniscedwyn Colliery Co.	Evan Jenkins	47	Labourer	Fall of side on incline, from corner of a man-hole, while deceased was placing trams, which had run wild, on the road.	–	1	–	–	–	1
3	Oct. 10 7.30 a.m.	1st	Ystradgynlais	Ystradgynlais	Ystradgynlais and Swansea Colliery Co. Limited.	William Samuel	57	Blocklayer	Killed by the fall of a shoot under a screen. The shoot was not in very good condition.	–	–	–	–	1	1
					COUNTY OF CARMARTHEN.										
4	Mar. 11 6.15 a.m.	1st	Ammanford	Ammanford	Ammanford Colliery Co., Limited.	John Morris	24	Rider	On engine plane. Fell off front of journey and was run over.	–	–	–	1	–	1
5	Feb. 10 10 p.m.	3rd	Llwyn	Llanelly	Nevill, Druce, & Co.	David Thomas	23	Collier	While riding up on a water tank with three others, in the absence of the rider, the tank tilted and he fell off and was fatally injured. The incline rose 33 in. per yard. There was only 5 in. clearance between top of tank and timbers.	–	–	–	1	–	1

List of Fatal Accidents—*continued.*

No. of Accidents.	Date and Hour of the Accident.	Hour of the Person's Shift, i.e., Number of Hours he had been at Work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Fire-damp.	Lives lost. Falls of Roof and Sides.	Lives lost. In Shafts.	Lives lost. Miscellaneous underground.	Lives lost. Above-ground.	Lives lost. Total.
						COUNTY OF GLAMORGAN.									
6	1893. Nov. 16 3 p.m.	8th	Aber - -	Tynewydd -	Cory Bros. & Co., Limited.	Thomas Clatworthy.	18	Haulier	Found fatally injured in front of tram which was partly upon him on a road dipping 5 in. per yard.	–	–	–	1	–	1
7	Feb. 28 8 a.m.	1st	Aberdare Works, River Level Pit.	Aberdare -	Aberdare Works and Collieries Co.	Thomas Edmunds	51	Collier -	Fatally injured while illegally unramming a missed shot.	–	–	–	1	–	1
8	Aug. 11 2 p.m.	7th	" Tunnel Pit	" -	" " -	John Jones -	55	" -	Fall of roof at face (12 ft. × 3½ ft. × 3½ ft. thick) between gob and face of coal in a heading cutting off faces. Six feet seam.	–	1	–	–	–	1
9	Sept. 12 9 a.m.	2nd	" " -	" -	" " -	Alfred Williams	33	" -	Fall of coal and clod at face, while about to set additional sprags, as the coal was getting "heavy." It should have been taken down before.	–	1	–	–	–	1
10	Oct. 28 1.30 p.m.	7th	" Windsor Level.	" -	" " -	Henry Harris -	16	Collier's boy.	Fall of roof at face, while working with another boy (his collier having left the stall to assist his brother). The deceased had started to get coal, when the roof at front of rippings fell. It was said there was a centre prop. Two-feet-nine seam.	–	1	–	–	–	1
11	Mar. 1 8 a.m.	1st	Abergorky -	Treorky -	Burnyeat, Brown, & Co.	W. T. Jones -	14	"	Fall of roof at face (7½ ft. × 4½ ft. × 26 ins. thick) from between two slips while carrying coal near waste. Three props were said to have been discharged. Roof very slanty. Six feet seam.	–	1	–	–	–	1

List of Fatal Accidents—*continued.*

No. of Accidents.	Date and Hour of the Accident.	Hour of the Person's Shift, *i.e.*, Number of Hours he had been at Work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost: Explosions of Fire-damp.	Lives lost: Falls of Roof and Sides.	Lives lost: In Shafts.	Lives lost: Miscellaneous underground.	Lives lost: Above-ground.	Lives lost: Total.
					County of GLAMORGAN—*continued.*										
12	1893. Apr. 20 11 a.m.	4th	Abergorky	Treorky	Burnyeat, Brown, & Co., Limited.	Francis Haines	20	Labourer	Fell under a tram of rubbish which was being drawn by a horse into a "stow road." Died 3rd June.	–	–	–	1	–	1
13	July 31 4 p.m.	8th	"	"	" "	George Merry	21	Collier	Struck on the head by a piece of coal falling down shaft while placing a mandril on a loaded tram at the pit bottom. Six feet seam.	–	–	1	–	–	1
14	Mar. 29 4 p.m.	8th	Albion	Cilfynydd	Albion Steam Coal Co., Limited.	David Watkins	26	"	A fall of side (clod) knocked out a pair of timbers upon him. The clod was slightly overhanging. Upper four feet seam. Died 4th April.	–	1	–	–	–	1
15	Sept. 15 12.30 a.m.	6th	"	"	" "	Thomas French	27	"	Fall of roof at face while cutting through a stump of bottom coal. There was room for timbers on each side of stump, but none were fixed. Upper four feet seam.	–	1	–	–	–	1
16	Aug. 16 7 a.m.	1st	Broadoak	Loughor	Samuel Thomas	Wm. J. Lewis	20	"	Fall of side (coal) which was overhanging and not spragged. Five feet seam. Pillar and stall.	–	1	–	–	–	1
17	Feb. 19 11 a.m.	4th	Bryndu and Cefn, Cefn Slip.	Pyle	Bryndu Coal and Coke Co., Limited.	George Flew	30	Labourer	While moving loaded trucks and walking backwards was crushed between truck and retaining wall.	–	–	–	–	1	1

List of Fatal Accidents—*continued.*

No. of Accidents.	Date and Hour of the Accident.	Hour of the Person's Shift, i.e., Number of Hours he had been at Work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost: Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous underground.	Above-ground.	Total.
					COUNTY OF GLAMORGAN—*continued.*										
18	1893. Sept. 28 10 a.m.	4th	Bryndu and Cefn, Cefn Slip.	Pyle - -	Bryndu Coal and Coke Co., Limited.	Jenkin Rees -	35	Repairer	By the breaking of a haulage rope while he was riding between trams up return "slip." Dip 18 ins. per yard.	–	–	–	1	–	1
19	May 2 4.30 a.m.	9th	Bwllfa Dare -	Aberdare -	Bwllfa and Merthyr Dare Steam Collieries Limited.	Richard Jones -	60	Labourer	Fell down the upcast shaft from the Gorllwyn seam. He had no business there.	–	–	1	–	–	1
20	Mar. 23 3.30 p.m.	8th	Cambrian Navigation.	Clydach Vale -	Thomas, Riches, & Co. -	Wm. Martin -	38	Haulier -	Found fatally injured between a tram and a pair of timbers. He was taking two trams (one containing a 9 in. prop and the other rubbish) towards the face, the road dipping slightly.	–	–	–	1	–	1
21	June 6 2.30 p.m.	5th	" " -	" -	" " -	William Evans -	68	Road cleaner.	Was knocked down by a horse and tram on a dip road. The horse had been left by the haulier in charge, and was startled by some small stones falling. The haulier was at least indirectly to blame.	–	–	–	1	–	1
22	June 15 2.30 p.m.	7th	" " -	" -	" " -	Samuel Williams	67	"	Found dead, having been run over by a journey of loaded trams on engine plane.	–	–	–	1	–	1
23	Oct. 20 2 p.m.	6th	" " -	" -	" " -	David Davies -	28	Repairer	While repairing, a small stone fell on his head, cutting it. He died from inflammation of the brain nine days afterwards, and had worked on four of these days.	–	1	–	–	–	1

List of Fatal Accidents—*continued.*

No. of Accidents.	Date and Hour of the Accident.	Hour of the Person's Shift, *i.e.*, Number of Hours he had been at Work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost: Explosions of Fire-damp.	Lives lost: Falls of Roof and Sides.	Lives lost: In Shafts.	Lives lost: Miscellaneous underground.	Lives lost: Above-ground.	Lives lost: Total.
					COUNTY OF GLAMORGAN—*continued.*										
24	1893. Oct. 25 4.30 p.m.	9th	Cambrian Navigation.	Clydach Vale -	Thomas Riches & Co. -	David Howells -	40	Master haulier.	Kicked by a horse in the stable, while attempting to raise another horse which had fallen in front of the stall.	–	–	–	1	–	1
25	Oct. 12 2 a.m.	5th	Cardiff Navigation.	Llantrissant -	T. J. Masters - -	G. Williams -	42	Collier -	Fall of roof at face (5 ft. × 2½ ft. × 14 in. thick) from between two slips. Roof not timbered. Cribbwr seam.	–	1	–	–	–	1
26	Aug. 18 7.30 a.m. 11.30 a.m.	2nd - 5th	Cefn Merthyr - ” ” -	Quaker's Yard ” ” -	Cefn Merthyr Colliery Co., Limited. ” ” -	Francis Derrick Thos. Jas. Davies Matthew Hughes	36 21 31	Overman Haulier Collier	Suffocated by choke-damp. (*See* Report) -	–	–	–	3	–	3
27	Mar. 16 3.30 p.m.	9th	Clydach Rhondda.	Tonypandy -	Wm. Perch & Co. -	Samuel Thompson.	21	Collier -	Fall of side (coal) at face (6 ft. in length), which was holed and not spragged. No. 2 Rhondda seam. Pillar and stall.	–	1	–	–	–	1
28	June 12 1 p.m.	6th	” ” -	” -	” ” -	John Harris -	15	”	Fall of roof at face, part of a "bell"; top coal worked 2 ft. in advance of bottom coal. The stone broke off at the nearest prop. No. 2 Rhondda seam. Pillar and stall.	–	1	–	–	–	1
29	June 4 7 p.m.	14th	Collenna -	Tonyrefail -	Glyn Colliery Co., Limited.	Harry Coleman	33	Labourer	Fell into a culvert, the crown of which collapsed as he was passing. The culvert conveyed fumes from some coke ovens, and deceased was so severely burned that he died 4 days after. The culvert had only been built 18 months.	–	–	–	–	1	1

List of Fatal Accidents—*continued.*

No. of Accidents.	Date and Hour of the Accident.	Hour of the Person's Shift, *i.e.*, Number of Hours he had been at Work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous underground.	Above-ground.	Total.
					COUNTY OF GLAMORGAN—*continued.*										
30	1893. Apr. 2 1 p.m.	6th	Cyfarthfa Castle	Merthyr	Crawshay Brothers, Limited.	Thomas Jones	59	Labourer	Died from injuries received while moving wagons.	–	–	–	–	1	1
31	May 31 5 p.m.	10th	" "	"	" "	William Thomas	73	"	Struck his head while entering the cage. The injury was so slight that it was not reported at the time. Died 17th June.	–	–	1	–	–	1
32	Feb. 10 1 a.m.	6th	Cyfarthfa Cwm	"	" "	Joseph Edwards	46	Ripper	Fall of roof on road, while resting under a portion of roof which he and his partner had been trying to blast down. Lower two-feet-nine seam.	–	1	–	–	–	1
33	Nov. 1 12 noon	5th	" "	"	" "	David Griffith	18	Collier	Fall of "face" slip of coal (9 ft. in length) which was said to have been spragged. Five feet seam.	–	1	–	–	–	1
34	Apr. 12 9.30 a.m.	2nd	Cyfarthfa Glyndurris.	"	" "	Daniel Jones	36	"	Fall of roof (coal) (6 ft. × 3 ft. × 2 ft. thick) while he was sounding it. One prop was discharged. Nine feet seam. Pillar and stall.	–	1	–	–	–	1
35	June 2 12.30 p.m.	6th	Cyfarthfa Newbridge Rhondda.	Pontypridd	" "	William Roberts	23	"	Fall of roof at face (3½ ft. × 3½ ft. × 1 ft. thick), while holing near the top of the seam. He had holed into a slip which ran into the roof. It was said there were three props under the portion that fell, but this appeared doubtful. No. 3 Rhondda seam. Narrow heading.	–	1	–	–	–	1

List of Fatal Accidents—*continued.*

No. of Accidents.	Date and Hour of the Accident.	Hour of the Person's Shift, i.e., Number of Hours he had been at Work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Repuied Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Fire-damp.	Lives lost. Falls of Roof and Sides.	Lives lost. In Shafts.	Lives lost. Miscellaneous underground.	Lives lost. Above-ground.	Lives lost. Total.
					COUNTY OF GLAMORGAN—*continued.*										
36	1893. Sept. 15 9.30 a.m.	2nd	Cyfarthfa New-bridge Rhondda.	Pontypridd -	Crawshay Brothers, Limited.	Evan Hughes -	20	Collier -	Fall of roof at face, while working at a corner next the "waste." A "bell" shaped stone (4 ft. dia. × $1\frac{1}{4}$ ft. thick). One prop was discharged. No. 3 Rhondda seam.	–	1	–	–	–	1
37	July 14 11.45p.m.	5th	Cwmaman -	Aberdare -	Cwmaman Coal Co. -	John Davies -	43	Repairer	Fall of roof on road, while clearing a fall. No double timbers. Six feet seam.	–	1	–	–	–	1
38	Oct. 11 4 p.m.	9th	" -	" -	" " -	David Thomas -	13	Collier's boy.	Fall of roof (rock), at face while carrying coal along the face. This stall was said to have been fairly well timbered, but the fall was such a large one that the statement could not be verified. Two-feet-nine seam.	–	1	–	–	–	1
39	Dec. 18 2.30 a.m.	8th	" -	" -	" " -	Evan Davies -	47	Repairer	Fall of stone near face, after ripping the roof. The stone had rested partly on the "gob," and had probably been loosened by the operation of ripping. Six feet seam. Died 30th December.	–	1	–	–	–	1
40	Apr. 1 7.55 a.m.	1st	Cymmer -	Cymmer -	Cymmer Colliery Co. -	Owen Jones -	29	Hitcher -	While crossing pit bottom was struck on the head by a piece of coal falling down the shaft. He should have gone by the back "slum."	–	–	1	–	–	1

List of Fatal Accidents—*continued*.

No. of Accidents.	Date and Hour of the Accident.	Hour of the Person's Shift, i.e., Number of Hours he had been at Work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost: Explosions of Fire-damp.	Lives lost: Falls of Roof and Sides.	Lives lost: In Shafts.	Lives lost: Miscellaneous underground.	Lives lost: Above-ground.	Lives lost: Total.
						COUNTY OF GLAMORGAN—*continued*.									
41	1893. Jan. 23 8.30 p.m.	7th	Dowlais: Dowlais Cardiff.	Aberdare Junction.	Dowlais Iron Company	William Tudor - Henry Caddy - Richard Davies - Robt. Roberts - Cad. Williams - John Williams - Godfrey Jones - David Jones -	34 38 54 32 25 37 20 46	Sinker " " " " " " "	Killed by a large fall from the side of sinking pit. (*See* Report.) Died 22nd February, from injuries by same fall.	–	–	8	–	–	8
42	Oct. 18 12.30 a.m.	5th	Dowlais: Bedlinog.	Bedlinog -	" " -	John Price -	14	Collier's boy.	Fall of coal (3 ft. × 8 in. × 8 in. thick) from face, which was said to be standing vertical. Raslas seam.	–	1	–	–	–	1
43	Sept. 21 1 p.m.	6th	Dowlais: Cwmbargoed.	Merthyr Tydfil	" " -	Thomas Rees -	12	"	Fall of side (coal and clod 5 ft. × 8 in. × 18 in. thick), the face was slightly overhanging but was not spragged. Top coal seam.	–	1	–	–	–	1
44	Oct. 17 9 p.m.	2nd	" "	" -	" " -	George Powell -	43	Repairer	Fall of small stone from a hole in the roof, where there had been a large fall, while he was clearing the side, making room for timbers. Lower four feet seam. Died 18th.	–	1	–	–	–	1
45	Feb. 24 8.40 p.m	2nd	Dowlais: Fochriw.	" -	" " -	Morgan Edwards	40	"	Fall of roof (7 ft. × 4 ft. × 10 in. thick) while re-opening an old heading. Raslas seam.	–	1	–	–	–	1

List of Fatal Accidents—*continued*.

No. of Accidents.	Date and Hour of the Accident.	Hour of the Person's Shift, i.e., Number of Hours he had been at Work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost: Explosions of Fire-damp.	Lives lost: Falls of Roof and Sides.	Lives lost: In Shafts.	Lives lost: Miscellaneous underground.	Lives lost: Above-ground.	Lives lost: Total.
						COUNTY OF GLAMORGAN—*continued*.									
46	1893. Jan. 4 10 a.m.	3rd	Dowlais: Nantwen.	Gelligaer	Dowlais Iron Co.	John Davies	73	Blocklayer	Crushed between the buffers of wagons, which another man was moving, while engaged in cleaning roads at screens.	–	–	–	–	1	1
47	Feb. 16 12.40 p.m.	6th	" "	"	"	Wm. H. Davies	17	Collier's boy.	Fall of roof at face, "bell" 3 ft. diameter, between props. Brithdir seam.	–	1	–	–	–	1
48	May 15 4.20 p.m.	10th	Dowlais: Tunnel.	"	"	Wm J. Spacey	14	Labourer	Fell down shaft from surface. He was wheeling a barrow across the shaft top on a plank stage 5 ft. wide, which was not fenced at the sides.	–	–	1	–	–	1
49	Dec. 3 9.40 a.m.	2nd	Dowlais: So. Tunnel.	"	"	Stephen Evans	58	Pit carpenter.	Crushed by pump beam while he was leaning over a "byatt."	–	–	–	–	1	1
50	July 4 7.45 a.m.	1st	Dunvant	Dunvant	Phillip Richards	Joseph Evans	13	Hitcher	Crushed between trams, while attempting to uncouple them while in motion.	–	–	–	–	1	1
51	Jan. 30 9.30 a.m.	3rd	Brithdir	Neath	Dynevor Duffryn Colliery Co.	D. J. Thomas	12	Collier's boy.	Fall of side at face (coal and clod 27 ft. × 16 in. × 22 in. thick) a most glaring case of want of sprags. Tir Edmund seam.	–	1	–	–	–	1
52	Apr. 22 12.40 a.m.	6th	Courtherbert	"	" "	John Lovering	13	Door-boy	Crushed between trams while attempting to shackle them before they had come to rest on the parting.	–	–	–	1	–	1
53	Apr. 28 2.30 p.m.	8th	Brithdir	"	" "	Charles James	70	Screenman	Fatally injured by a lump of coal falling down the screen at which he was engaged. Died 10th May.	–	–	–	–	1	1

List of Fatal Accidents—*continued.*

No. of Accidents.	Date and Hour of the Accident.	Hour of the Person's Shift, *i.e.*, Number of Hours he had been at Work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous underground.	Above-ground.	Total.
					COUNTY OF GLAMORGAN—*continued.*										
54	1893. June 23 10 p.m.	3rd	No. 1 Ferndale	Ferndale -	D.Davis & Sons, Limited	James Pritchard	58	Labourer	Fall of roof while resting with his partner near face of stall under edge of rippings, 4 yards from where they were gobbing rubbish. Six feet seam.	–	1	–	–	–	1
55	Apr. 8 6 a.m.	11th	No. 3 „	Ystrad -	„ „ -	Thomas Davies -	18	Repairer	While ascending was crushed between "byatts" and cage, having got on after it was signalled away.	–	–	1	–	–	1
56	Nov. 23 9.30 a.m.	3rd	„ „	„ -	„ „ -	William Jones -	21	Engine Driver.	Fell off front of journey and was run over. He had no authority to act as rider.	–	–	–	1	–	1
57	Dec. 14 8 p.m.	1st	„ „	„ -	„ „ -	Rowland Rees -	41	Labourer	While assisting the hitcher to pull a tram out of cage, the cage was lifted and he was crushed against the "byatt."	–	–	1	–	–	1
58	Jan. 26 1.30 p.m.	7th	No. 4 „	Ferndale -	„ „ -	Donald Flaherty	69	„	While cleaning the rails about the screens, a wagon moved forward a little, and he fell with his leg under the wheel. Died 12th March.	–	–	–	–	1	1
59	Oct. 5 10 a.m.	3rd	No. 5 „	„ -	„ „ -	John Allsops -	17	Assistant Haulier.	Supposed to have fallen in running forward to open a door, and horse and tram ran over him. The haulier said he was behind the two trams.	–	–	–	1	–	1

List of Fatal Accidents—*continued.*

No. of Accidents.	Date and Hour of the Accident.	Hour of the Person's Shift, i.e., Number of Hours he had been at Work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous underground.	Above-ground.	Total.
					COUNTY OF GLAMORGAN—*continued.*										
60	1893. Oct. 10 3 p.m.	8th	No. 5 Ferndale	Ferndale	D. Davis & Sons, Limited	Gwynne Thomas	53	Collier	Fall of roof, (11 ft. 6 in. × 4 ft. 6 in. × 15 in. thick) while placing a stone beneath some rippings, which he was getting down by wedging. Five feet seam.	–	1	–	–	–	1
61	Mar. 8 11.30 a.m.	4th	Fernhill	Treherbert	Fernhill Merthyr Colliery Company.	James Edwards	—	"	Fall of roof at face, while setting a prop. Died 16th March. Two-feet-nine seam.	–	1	–	–	–	1
62	Apr. 11 7.15 a.m.	1st	Ffaldau	Pontycymmer	Ffaldau Coal Co.	John Fox	20	Haulier	Fall of roof on road, a tram got off the rails and knocked a pair of timbers out. This was a large fall. Two-feet-nine seam.	–	1	–	–	–	1
63	Jan. 17 8 a.m.	2nd	Foxhole: Pwll Mawr Pit.	Llansamlet	Foxhole Collieries Co.	James Pascoe	67	Labourer	While he and others were unloading pitwood from trucks standing on an incline, with the brakes down and the wheels spragged, the upper truck moved forward, and a temporary stage on which he was standing gave way and he fell amongst the wheels.	–	–	–	–	1	1
64	Oct. 28 8.30 a.m.	2nd	" "	"	" "	Ed. Williams	45	Collier	Fall of side (coal 12 ft. × 2 ft. × 4 ft. thick) while holing without sprags.	–	1	–	–	–	1
65	Apr. 5 10 p.m.	3rd	Gadlys: Graig Pit.	Aberdare	Wayne's Merthyr Co., Limited.	James Jones	54	Repairer	Fall of roof (3 ft. × 3 ft. × 18 in. thick) while wedging it down. Seven feet seam.	–	1	–	–	–	1

List of Fatal Accidents—*continued.*

No. of Accidents.	Date and Hour of the Accident.	Hour of the Person's Shift, *i.e.*, Number of Hours he had been at Work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous underground.	Above-ground.	Total.
					COUNTY OF GLAMORGAN—*continued.*										
66	1893. Dec. 23 12.30p.m.	6th	Gadlys: Graig Pit.	Aberdare	Waynes Merthyr Co., Limited.	John Davies	22	Collier	Fall of side (triangular piece of clod 2 ft. 10 in. × 3 ft. 10 in. × 2 ft. 10 in. thick) from a bed which had just been ripped on the road. It was supported by two props and the gob.	–	1	–	–	–	1
67	Jan. 7 1 a.m.	7th	Gelli	Ystrad	Gelli and Tynybedw Collieries Co.	John Jones	28	Haulier	Fall of roof on road while taking empty tram in, the tram getting off the rails and knocking a pair of timbers out. Two feet nine seam.	–	1	–	–	–	1
68	Jan. 18 2 p.m.	8th	Glyn	Llantrissant	Glyn Colliery Co., Limited.	John Matthews	25	Collier	Fall of rock roof at face (10 ft. 6 in. × 3 ft. 10 in. × 23 in. thick) while building a stone cog. No. 3 Rhondda seam.	–	1	–	–	–	1
69	April 5 5 a.m.	10th	"	"	" "	David Jenkins	20	"	While riding between trams up an incline, gradient 18 in. to 34 in. per yard, the hitching plate of first tram broke.	–	–	–	1	–	1
70	May 26 5.30 a.m.	11th	"	"	" "	Morgan Morris	25	"	While riding with other colliers, in the absence of the rider, on the front of a journey of trams, his head caught between the roof and top of tram.	–	–	–	1	–	1
71	Sept. 14 9.30 a.m.	3rd	Glyncorrwg	Glyncorrwg	Glyncorrwg Colliery Co.	Thomas Vickers	64	"	Fall of roof at face (a "bell stone" 9 ft. × 5 ft. × 16 in. thick) while filling coal. No props set up. No. 2 Rhondda seam.	–	1	–	–	–	1

List of Fatal Accidents—*continued.*

No. of Accidents.	Date and Hour of the Accident.	Hour of the Person's Shift, *i.e.*, Number of Hours he had been at Work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous underground.	Above-ground.	Total.
						County of GLAMORGAN—*continued.*									
72	1893. Sept. 19 8.30 a.m.	2nd	Gorseinon -	Gorseinon -	Glasbrook Brothers -	James Jenkins -	45	Airway-man.	Fall of roof in airway (3 ft. × 2 ft. × 1 ft. thick) while waiting for the fireman to knock through from the face of a cross hole to cut off a bad piece of the airway. Six feet seam.	–	1	–	–	–	1
73	Sept. 1 8.30 a.m.	2nd	Graigola Merthyr: Clydach Merthyr.	Clydach -	Graigola Merthyr Co., Limited.	Philip Jones -	73	Roadman	Knocked down by a tram while cleaning the road. He stepped out of the way of a full tram and into the way of an empty tram coming in the opposite direction.	–	–	–	–	1	1
74	Dec. 9 12.30p.m.	6th	Graigola Merthyr: Hill's Merthyr.	" -	" " -	John Williams -	18	Hitcher -	Fell off journey while riding. He had duties at two points, but it was stated that he was not allowed to ride between these points.	–	–	–	1	–	1
75	Apr. 11 1.30 p.m.	7th	Great Western	Pontypridd -	Great Western Colliery Co., Limited.	63 persons -	—	- -	By an underground fire (*see* Report, and Special Report dated 26th May 1893).	–	–	–	63	–	63
76	May 19 1.30 p.m.	7th	" -	" -	" " -	David Llewellyn	19	Assistant hitcher.	While crossing shaft bottom the cage descended upon him.	–	–	1	–	–	1
77	May 29 930 a.m.	3rd	" -	" -	" " -	Wm. Harries -	44	Collier -	Fall of roof (coal) at face. Top coal ripped in roads but kept up where possible along face. Four feet seam.	–	1	–	–	–	1

List of Fatal Accidents—*continued.*

No. of Accidents.	Date and Hour of the Accident.	Hour of the Person's Shift, i.e., Number of Hours he had been at Work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Fire-damp.	Lives lost. Falls of Roof and Sides.	Lives lost. In Shafts.	Lives lost. Miscellaneous underground.	Lives lost. Above-ground.	Lives lost. Total.
					COUNTY OF GLAMORGAN—*continued.*										
78	1893. Sept. 7 12.50p.m.	6th	Great Western	Pontypridd -	Great Western Colliery Co., Limited.	David Basset - Henry Thomas -	60 50	Roadman Platelayer	Crushed by runaway trams at the bottom of the rubbish tip incline in consequence of the breaking of a hitching plate. Henry Thomas died 9th September.	–	–	–	–	2	2
79	Sept. 27 4.5 p.m.	9th	" " -	" -	" " -	Herbert Thomas	33	Collier -	Fall of roof on main road as he was passing. He had been cautioned by the rider not to pass as the roof was "uneasy." Four feet seam.	–	1	–	–	–	1
80	Nov. 18 9.30 a.m.	3rd	" " -	" -	" " -	Hugh Hughes -	22	" -	Fall of roof at face; died on December 25th from injuries which were considered slight and not reported at time. Five feet seam.	–	1	–	–	–	1
81	Feb. 28 2 p.m.	7th	Harris' Navigation.	Treharris -	Deep Navigation Collieries, Limited.	Thos. Emanuel -	27	Haulier -	Died on 10th March from lockjaw resulting from injuries to his hand while spragging tram wheel.	–	–	–	1	–	1
82	June 8 8.30 a.m.	2nd	" " -	" -	" " -	Thos. Phillips -	57	Collier -	Fall of side (coal) while he was pulling it down. Six feet seam.	–	1	–	–	–	1
83	Nov. 13 11.30a.m.	4th	LlantwitMerthyr	Near Briton Ferry.	Llantwit Merthyr Colliery Co.	Ben Jones -	17	" -	Fall of roof (a "bell" stone) at face. Roof propped on each side. Wenallt seam. Died on 17th November.	–	1	–	–	–	1
84	May 18 1.15 p.m.	7th	Lewis' Merthyr: " Coedcae.	Havod -	Lewis' Merthyr Navigation Colliery Co., Limited.	Chris. Matthews	22	" -	Fall of roof (5 ft. × 6 ft. × 7 in. thick) at face, propped at each side. Died on 1st September. Havod seam.	–	1	–	–	–	1

List of Fatal Accidents—*continued.*

No. of Accidents.	Date and Hour of the Accident.	Hour of the Person's Shift, *i.e.*, Number of Hours he had been at Work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous underground.	Above-ground.	Total.
					COUNTY OF GLAMORGAN—*continued.*										
	1893.														
85	Apr. 24 8 a.m.	1st	Lewis' Merthyr: „ Bertie Pit	Havod -	Lewis' Merthyr Navigation Colliery Co., Limited.	D. J. Coles -	20	Collier -	Fall of roof at face (18 ft. × 2 ft. × 17 in. thick) from a break running along face. Well propped outside. Four feet seam.	–	1	–	–	–	1
86	Sept. 22 8.15 p.m.	2nd	Llest - -	Pontyrill -	Llest Coal Co., Limited	Rees Davies - Wm. Davies -	48 19	„ - „	By outburst of coal (*see* Report) - -	–	–	–	2	–	2
87	Jan. 14 2 a.m.	7th	Lletty Shenkin	Aberdare -	Burnyeat, Brown, & Co., Limited.	Wm. Williams -	63	Labourer	Died from injuries to his arm by tram passing over it, while assisting a haulier to move the tram on a heading. This accident was not reported at the time of its occurrence. Died 13th February.	–	–	–	1	–	1
88	Apr. 18 10 a.m.	3rd	„ „ -	„ -	„ „ -	David Davies -	63	Collier -	Fall of coal which was not spragged. Four feet seam.	–	1	–	–	–	1
89	Oct. 9 5 a.m.	7th	Llwynypia -	Llwynypia -	Glamorgan Coal Co., Limited.	Joseph Lewis -	34	Timberman	Fall of roof on road while ripping. Six feet seam.	–	1	–	–	–	1
90	Aug. 25 12 noon	5th	Mardy -	Mardy -	Locket's Merthyr Steam Coal Co., Limited.	Richard Hughes	40	Tipper -	Crushed between trams while tipping at screens. Died 2nd September.	–	–	–	–	1	1
91	Mar. 9 1.30 p.m.	6th	Meiros -	Llanharran -	Welsh Estate and Property Co., Limited.	John Sheppard -	38	Ostler -	He was assisting to move a loaded wagon on a siding, using a prop to the wheel as a lever, when he slipped and fell with his head against the axle box. Died 25th March.	–	–	–	–	1	1

List of Fatal Accidents—*continued.*

No. of Accidents.	Date and Hour of the Accident.	Hour of the Person's Shift, *i.e.*, Number of Hours he had been at Work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous underground.	Above-ground.	Total.
					COUNTY OF GLAMORGAN—*continued.*										
92	1893. Nov. 10 11.50a.m.	5th	Moody's Graigola	Clydach	Moody Brothers & Co.	D. J. Williams	—	Collier	Fall of side (coal); a most glaring case of want of sprags. Graigola seam.	–	1	–	–	–	1
93	Feb. 23 11.15a.m.	5th	Mountain	Gorseinon	Sterry's Mountain Colliery Co.	D. M. Davies	16	Billy boy	Crushed between trucks and retaining wall while moving a wagon. It was not his own work. Died 27th February.	–	–	–	–	1	1
94	Dec. 22 10 a.m.	3rd	Nantmelyn	Aberdare	Nantmelyn Colliery Co., Limited.	William Jones James Proul	36 17	Collier "	Fall of rock roof (11 ft. × 9 ft.) from a clay joint in a narrow heading. No timbers had been stood. Proul died 5th January 1894. yard seam.	–	2	–	–	–	2
95	Aug. 25 12 a.m.	5th	Nant Merthyr	Crynant	David Thomas	Morgan Jones Roger Elias	20 18	Haulier Collier	Fall of roof on road, while turning a tram at a parting for the haulier to pass out with full tram. Road not double timbered. Red seam.	–	2	–	–	–	2
96	Feb. 14 2 p.m.	7th	National	Wattstown	United National Collieries, Limited.	James Richards	43	Master Haulier.	Fell down a staple pit while adjusting a tram in cage. Died 15th February.	–	–	1	–	–	1
97	Dec. 14 8.45 p.m.	2nd 13th 13th 13th	Naval	Penygraig	Naval Colliery Co., Limited.	John Way William Rogers Bertie Horton Henry Avery	38 36 20 22	Overman Shoer Striker "	Fell out of cage (*see* Report)	–	–	4	–	–	4
98	1892. Dec. 6 3.30 p.m.	9th	Nixon's Navigation:— Cwm Cynon	Mountain Ash	Nixon's Navigation Co., Limited.	Thos. Samuel	38	Collier	Fall of roof at face. Died 29th June from injuries received on 6th December 1892. No. 3 Rhondda seam.	–	1	–	–	–	1

List of Fatal Accidents—*continued.*

No. of Accidents.	Date and Hour of the Accident.	Hour of the Person's Shift, *i.e.*, Number of Hours he had been at Work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous underground.	Above-ground.	Total.
						COUNTY OF GLAMORGAN—*continued.*									
99	1893. Aug. 4 11.45a.m.	5th	Nixon's Navigation :—Deep Duffryn	Mountain Ash	Nixon's Navigation Co., Limited.	Joseph Morgan -	43	Collier -	Fall of roof at face (coal). This was a very large fall; the face was said to have been well timbered. Nine feet seam.	–	1	–	–	–	1
100	June 29 10 a.m.	3rd	" Merthyr Vale.	Merthyr Vale	" " -	John Davies -	71	Pumpman	Died on 13th July from injuries received by a tram crushing him against the side.	–	–	–	1	–	1
101	Oct. 7 4.30 p.m.	10th	" "	" -	" " -	Wm. Bowman -	20	Haulier -	Crushed between prop on roadside and tram, while starting a loaded tram from face. There was plenty of room on the opposite side.	–	–	–	1	–	1
102	Oct. 18 8.30 a.m.	1st	" "	" -	" " -	Wm. James -	65	Roadman	Run over by journey on engine-plane -	–	–	–	1	–	1
103	Apr. 27 11 a.m.	4th	" Navigation	Mountain Ash	" " -	Job Mazey -	32	Haulier -	Fall of roof on road, while taking a full tram of rubbish into a rubbish stall. Six feet seam.	–	1	–	–	–	1
104	July 12 4.30 p.m.	10th	" "	" -	" " -	James Parfit -	35	Collier -	Fall of roof at face, while about to set up a prop. The face had been standing a fortnight. Died from injuries received 26th July. Four feet seam.	–	1	–	–	–	1
105	Nov. 20 10.30a.m.	4th	" "	" -	" " -	Pat Toney -	28	Haulier -	Fall of roof on road which was not timbered. Four feet seam. Died 23rd November.	–	1	–	–	–	1

List of Fatal Accidents—*continued.*

No. of Accidents.	Date and Hour of the Accident.	Hour of the Person's Shift, *i.e.*, Number of Hours he had been at Work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous underground.	Above-ground.	Total.
					COUNTY OF GLAMORGAN—*continued.*										
106	1893. Dec. 23 7.30 a.m.	1st	Nixon's Navigation.	Mountain Ash	Nixon's Navigation Co., Limited.	William West -	37	Collier -	Fall of roof at face. In taking down slip of coal, the coal in falling knocked out a prop, when the roof fell. Two-feet-nine seam.	–	1	–	–	–	1
107	Nov. 11 9.30 a.m.	3rd	North's Navigation:— Caerau	Maesteg -	North's Navigation Collieries, Limited.	William Davies -	15	Collier's boy.	Fall of roof (7 ft. × 3½ ft. × 7 in. thick) at face while taking down clod. Six feet seam. Died the 13th.	–	1	–	–	–	1
108	June 21 6 a.m.	1st	" Coegnant	" -	" " -	Thomas James -	16	"	Fall of side (8 ft. × 9 in. × 14 in. thick, coal) at face, which was overhanging but not sufficiently spragged. Four feet seam.	–	1	–	–	–	1
109	Mar. 1 8 a.m.	1st	" No. 9 -	" -	" " -	Thomas Young -	56	Collier -	Fall of roof (4½ ft. × 2 ft. × 10 in. thick) at face while cutting at the rib just inside a small fault. Victoria seam.	–	1	–	–	–	1
110	Oct. 4 11 a.m.	3rd	" " -	" -	" " -	James Murphy -	12	Collier's boy.	Fall of roof at face (5 ft. × 4 ft. × 2 ft. thick) while filling coal at the face and another boy was "holing." One prop discharged. The collier was on the road. Victoria seam.	–	1	–	–	–	1
111	Jan. 22 1 a.m.	10th	" Wyndham	Nantymoel -	" " -	James Smith -	37	Repairer-	Fall of piece of roof, from edge of ripping where heading was being enlarged, while he was breaking some big stones below the opening between old and new timbers. Two-feet-nine seam.	–	1	–	–	–	1

List of **Fatal Accidents**—*continued.*

No. of Accidents.	Date and Hour of the Accident.	Hour of the Person's Shift, i.e., Number of Hours he had been at Work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost: Explosions of Fire-damp.	Lives lost: Falls of Roof and Sides.	Lives lost: In Shafts.	Lives lost: Miscellaneous underground.	Lives lost: Above-ground.	Lives lost: Total.
					County of GLAMORGAN—*continued.*										
112	1893. Oct. 28 11 a.m.	5th	North's Wyndham.	Nantymoel	North's Navigation Collieries, Limited.	Henry Boundy	21	Brakesman	Crushed between a wagon which he was moving and the upright of the screen. There was only 16 in. clearance.	–	–	–	–	1	1
113	July 25 5.40 a.m.	22nd	Ocean: „ Deep Navigation.	Treharris	Ocean Coal Co.	Thomas Jones	64	Engineman	Found dead under crank of air-compressing engine.	–	–	–	–	1	1
114	Sept. 29 9.30 p.m.	3rd	„ „	„	„	Wm. Burrows	36	Mason's labourer.	Fall of roof on a main road where some arching was being put in. Six feet seam.	–	1	–	–	–	1
115	July 29 2 p.m.	7th	„ „	„	„	Emanuel Jacob	—	Collier	Overstrained himself by pushing a tram. Died on 8th September.	–	–	–	1	–	1
116	June 12 8.30 a.m.	2nd	„ Garw	Blaengarw	„	John Jones David Jones	21 18	„ „	Fatally injured by a loaded tram, which had been left standing on an inclined road, running back wild into their stall, but how it came to do so was not satisfactorily ascertained. There appeared to have been carelessness in the changing of the trams.	–	–	–	2	–	2
117	Mar. 2 11 a.m.	4th	„ Lady Windsor	Ynysbwl	„	George Price	32	Collier	Fall of side at face (8 ft. × 3 ft. 9 in. × 3 ft. thick); it was resting partly on cogs and two props. No. 2 seam.	–	1	–	–	–	1
118	Jan. 16 11 p.m.	4th	„ Maindy	Ton. Pentre	„	Thos. Thomas	24	Ripper	Fall of side which they were blasting to enlarge the road.	–	1	–	–	–	1

List of Fatal Accidents—*continued.*

No. of Accident.	Date and Hour of the Accident	Hour of the Person's Shift, i.e., Number of Hours he had been at Work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Fire-damp.	Falls of Roof and Sides.	In Shaft.	Miscellaneous Underground.	Above-ground.	Total.
					COUNTY OF GLAMORGAN—*continued.*										
119	1893. Apr. 11 12.30p.m.	5th	Ocean : Maindy	Ton. Pentre -	Ocean Coal Co. -	Wm. Evans -	41	Collier -	Fall of side (11½ ft. × 2¼ ft. × 14 in.) from edge of rippings near face.	–	1	–	–	–	1
120	July 10 5.30 a.m.	6th	" " -	" -	" - -	Henry Kurton -	18	Haulier -	Fall of roof on road. While bringing a journey of trams round a turn from heading into a main road some old timbers broke down and the roof fell. This was a "bridge" between two high places on the main road and should have been taken down.	–	1	–	–	–	1
121	Mar. 13 4.30 p.m.	9th	" Park -	Treorky -	" - -	John T. Morris-	23	" -	Fall of roof on road, while passing along a heading with his horse, which was also killed. There were double timbers from 4 ft. to 5 ft. apart. Lower seam.	–	1	–	–	–	1
122	June 15 4 p.m.	9th	" Western-	Nantymoel -	" - -	Alfred Thomas -	28	Collier -	Fall of roof on road, while resting on side of heading. The place was said to have been well timbered. Six feet seam.	–	1	–	–	–	1
123	Feb. 20 1 p.m.	6th	Penrhiwfer -	Penygraig -	Glamorgan Coal Co., Limited.	David Williams -	23	Haulier -	Fall of side on road. No. 3 Rhondda seam; highly inclined.	–	1	–	–	–	1
124	May 12 2.30 a.m.	8th	" -	" -	" " -	David Thomas -	39	Fireman -	Run over by trams while walking up slant. Died 25th June.	–	–	–	1	–	1

List of Fatal Accidents—*continued.*

No. of Accidents.	Date and Hour of the Accident.	Hour of the Person's Shift, *i.e.*, Number of Hours he had been at Work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous underground.	Above-ground.	Total.
						County of GLAMORGAN—*continued.*									
125	1893. Aug. 8 12.30a.m.	6th	Penrhiwfer -	Penygraig -	Glamorgan Coal Co., Limited.	Gomer Williams	25	Assistant timberman.	Fall of roof on road, while he was filling a tram of rubbish, and his partner was knocking out an old collar. No. 3 Rhondda seam.	–	1	–	–	–	1
126	Feb. 18 7.30 a.m.	1st	Penrikyber -	Mountain Ash	Penrikyber Navigation Colliery Co., Limited.	William Miles -	28	Haulier -	In moving a tram by hand assisted by a collier, it overpowered them, and deceased, who was in front, was crushed against a pair of timbers at a bend where the tram left the rails. This was an improper method of moving a tram.	–	–	–	1	–	1
127	Nov. 28 12.30a.m.	6th	" -	" -	" " -	David Lloyd -	52	Repairer -	Fall of a small piece of stone from the roof on road while re-timbering a large hole. Four feet seam.	–	1	–	–	–	1
128	Oct. 25 4 p.m.	9th	Pentre -	Ystrad -	Gelli & Tynybedw Collieries Co., Limited.	Thomas Howells	53	Labourer	Run over by journey on engine plane while coming out to pit.	–	–	–	1	–	1
129	Oct. 9 10 a.m.	3rd	Plymouth: Abercanaid.	Merthyr Tydvil	Hill's Plymouth Co., Limited.	Thomas Davies -	16	Collier's boy.	Fall of roof while making room for a "cog." This was a known bad stone and was supported by props, but should have been taken down. Six feet top coal seam. Died 19th October.	–	1	–	–	–	1
130	Feb. 25 4.30 a.m.	10th	" So. Duffryn	"	" " -	Henry Dowling	36	Collier -	Fall of side (coal) at the corner of rib. The coal was broken and supported by props but was not spragged. Four feet seam.	–	1	–	–	–	1

List of Fatal Accidents—*continued.*

No. of Accidents.	Date and Hour of the Accident.	Hour of the Person's Shift, i.e., Number of Hours he had been at Work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosion of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous underground.	Above-ground.	Total.
					County of GLAMORGAN—*continued.*										
131	1893. April 8 1 p.m.	7th	Plymouth: So. Duffryn.	Merthyr Tydvil	Hill's Plymouth Co., Limited.	Pat. Denyon -	15	Signal attendant.	Crushed by runaway trams which had uncoupled themselves on engine plane.	–	–	–	1	–	1
132	Nov. 4 4.45 a.m.	10th	" " -	"	" " -	Jonah Thompson	26	Stower -	Run over by an empty journey while coming out to shaft.	–	–	–	1	–	1
133	Mar. 22 12 noon	5th	Powell Duffryn: Cwmneol.	Aberdare -	Powell Duffryn Steam Coal Co., Limited.	Fred. Pontin -	15	Collier's boy.	Fall of coal at face which was not spragged. Four feet seam. Died 26th March.	–	1	–	–	–	1
134	Apr. 28 3 p.m.	8th	" " -	" -	" " -	Rees Rees -	69	Manager	Struck by a journey of loaded trams while walking up engine plane.	–	–	–	1	–	1
135	Oct. 31 4.50 p.m.	10th	" George -	Mountain Ash	" " -	Joseph Collins -	54	Lamp-lighter.	Run over by a journey of trams while coming out to shaft.	–	–	–	1	–	1
136	Sept. 28 12.30p.m.	6th	" Lower Duffryn	"	" " -	John Griffiths -	20	Shackler-	Crushed between trams and side of road, the trams having got away from the point where they were supposed to be left fastened by a chain until taken away by hauliers. There must have been some carelessness on the part of the hauliers. Died 29th September.	–	–	–	1	–	1
137	July 14 2 p.m.	7th	" Treaman -	Aberdare -	" " -	James Taylor -	42	Collier -	Fall of roof (6 ft. × 3 ft. × 14 in. thick) at face, between timbers. Died 5th November. Two-feet-nine seam.	–	1	–	–	–	1

List of Fatal Accidents—*continued.*

No. of Accidents.	Date and Hour of the Accident.	Hour of the Person's Shift, i.e., Number of Hours he had been at Work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosion of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous underground.	Above-ground.	Total.
					COUNTY OF GLAMORGAN—*continued.*										
138	1893. May 25 5.40 p.m.	10th	Seven Sisters -	Nr. Neath -	Evans and Bevan -	Phillip George -	16	Collier's boy.	Crushed between the buffers of trucks while attempting to pass between them, a locomotive having at that moment joined the trucks.	–	–	–	–	1	1
139	Jan. 11 1.30 p.m.	6th	Squborwen -	Aberdare -	Samuel Thomas & Co. -	David Edwards -	20	Rider -	Tram got off the rails, and in jumping off the "bridle" he fell, and was run over. Died 8th March.	–	–	–	1	–	1
140	Aug. 27 9.30 a.m.	3rd	Tondu -	Tondu -	Tondu Colliery Co., Limited.	Joseph Harry -	56	Fireman	Drowned in a deep - - - -	–	–	–	1	–	1
141	Oct. 20 9.30 a.m.	4th	" -	" -	" " -	John Thomas -	16	Trammer	Fall of roof on road; this piece of roof was a "bridge" which should have been ripped down as it was too low to admit of timbers. Five-quarter seam.	–	1	–	–	–	1
142	Sept. 15 12.30p.m.	6th	Tower -	Hirwain -	Marquess of Bute -	Gomer Jones -	26	Collier -	Fall of roof (clod 9 ft. × 4 ft. × 6 in. thick) at face. No timbers set. Seven feet seam. Died September 21st.	–	1	–	–	–	1
143	Sept. 8 6.80 p.m.	1st	Tylors -	Tylorstown -	A. Tylor & Co., Limited	Fred Aplen -	39	" -	Fall of roof on main road, while he was passing into work. It was a double parting which was not timbered. Six feet seam.	–	1	–	–	–	1
144	June 19 2 p.m.	1st	Tynybedw -	Pentre -	Gelli and Tynybedw Collieries Co., Limited.	Owen Blayney -	66	Labourer	Fall of roof on a heading. This was a small stone from between the lags. Nine feet seam. Died November 8th.	–	1	–	–	–	1

List of Fatal Accidents—*continued.*

No. of Accidents.	Date and Hour of the Accident.	Hour of the Person's Shift, i.e., Number of Hours he had been at Work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous underground.	Above-ground.	Total.
					County of GLAMORGAN—*continued.*										
145	1893. Nov. 4 11 a.m.	4th	Tynybedw -	Pentre - -	Gelli and Tynybedw Collieries Co., Limited.	John Howells -	44	Collier -	Fall of coal. Crushed against a prop by the coal as he was taking it down. Nine feet seam. Died 8th November.	–	1	–	–	–	1
146	Feb. 11	10th	Werfa - -	Aberdare -	Jas. Evens and Co., Limited.	John Sefton -	24	Hitcher -	Explosion of gas in the sump (*see* Report) -	1	–	–	–	–	1
147	Sept. 7 2 a.m.	7th	Worcester -	Forestfach -	Phillip Richards - -	James Evans -	34	Collier -	Deceased and a trammer were about to lower a tram, by means of a windlass, down a short incline, when the handle came off and he was pushed down the incline by the tram and killed. Five feet seam.	–	–	–	1	–	1
148	Nov. 17 10 a.m.	3rd	" -	"	" -	William Williams	63	Repairer	Fall of roof on road while drawing out timbers.	–	1	–	–	–	1
149	Jan. 31 12.30p.m.	6th	Ynysfeio -	Treherbert -	Troedyrhiw Coal Co. -	Thos. C. Evans -	20	Collier -	Fall of face slip of coal (7 ft. × 18 in. × 2 ft. 9 in. thick), which was not spragged. Two-feet-nine seam.	–	1	–	–	–	1
									Total -	1	84	21	103	19	22[illegible]

LIST of the FATAL ACCIDENTS, and DEATHS arising therefrom, on PRIVATE BRANCH RAILWAYS and TRAMWAYS, and in WASHING and COKING COAL on the PREMISES adjacent to or belonging to the Mine during the year 1893.

Date and Hour of the Accident.	Hour of the Person's Shift, i.e., Number of Hours he had been at Work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Person killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost.
Jan. 13 7.15 A.M.	2nd	Llynfi Valley -	Llangynwyd -	Oliver H. Thomas - -	Benjamin Hill -	15	Haulier -	Fatally injured while hauling a truck out from coke ovens, by getting his foot fast in the point. He died on the 20 January.	1
								Total - - -	1

TABLE showing the Hour of DECEASED PERSONS' SHIFTS when FATAL ACCIDENTS occurred in 1893.

—	Underground.													Surface (A., B., and C.)													Total Number of Fatal Accidents.	Total Number of Lives Lost.
	1st Hour.	2nd Hour.	3rd Hour.	4th Hour.	5th Hour.	6th Hour.	7th Hour.	8th Hour.	9th Hour.	10th Hour.	11th Hour.	12th Hour.	Above 12th Hour.	1st Hour.	2nd Hour.	3rd Hour.	4th Hour.	5th Hour.	6th Hour.	7th Hour.	8th Hour.	9th Hour.	10th Hour.	11th Hour.	12th Hour.	Above 12th Hour.		
Separate Fatal Accidents -	13	14	17	11	11	18	15	9	12	9	2	—	—	3	3	1	1	3	2	1	1	1	1	—	—	2	150	—
Lives lost by the above Accidents	13	17	18	11	13	18	84	9	12	9	2	—	3*	3	3	1	1	3	3	1	1	1	1	—	—	2	—	229

* These three persons were killed in their 13th hour of work, being blacksmiths and rope splicers working overtime; by the same accident another person in his 2nd hour of shift was also killed, and the accident is entered under that hour.

Reports of Assistants.

SIR, Neath, 1st January 1894.

IN pursuance of section 20 of the Metalliferous Mines Regulation Act, 1872, I have the honour to report that during the past year I have exercised the duties of Inspector of Mines in the South Wales District, and in doing so I have acted as assistant to, and under the directions of, Mr. J. T. Robson, the Chief Inspector of that district.

I have, &c.
(Signed) FRED A. GRAY.

The Right Hon. H. H. Asquith, Q.C., M.P.,
Her Majesty's Principal Secretary of State,
Home Department.

114, Newport Road,
SIR, Roath, Cardiff, 1st January 1894.

IN pursuance of section 20 of the Metalliferous Mines Regulation Act, 1872, I have the honour to report that during the past year I have exercised the duties of an Inspector of Mines in the South Wales District, and in so doing I have acted as assistant to, and under the direction of, Mr. J. T. Robson, the Chief Inspector of that district.

I have, &c.
(Signed) J. MANCEL SIMS.

The Right Hon. H. H. Asquith, Q.C., M.P.,
Her Majesty's Principal Secretary of State,
Home Department.

SIR, Swansea, 1st January, 1894.

IN pursuance of section 20 of the Metalliferous Mines Regulation Act, 1872, I have the honour to report that during the past year I have exercised the duties of Inspector of Mines in the South Wales District, and in so doing I have acted as assistant to, and under the directions of, Mr. J. T. Robson, the Chief Inspector of that district.

I have, &c.
(Signed) J. DYER LEWIS.

The Right Hon. H. H. Asquith, Q.C., M.P.,
Her Majesty's Principal Secretary of State,
Home Department.

REPORT

OF

J. B. ATKINSON, Esq., H.M. INSPECTOR OF MINES

FOR THE

EAST SCOTLAND DISTRICT (No. 1),

TO

HER MAJESTY'S SECRETARY OF STATE,

UNDER

The Coal Mines Regulation Act, 1887,
the Metalliferous Mines Regulation Acts, 1872 and 1875, and
the Slate Mines (Gunpowder) Act, 1882;

For the Year 1893.

Presented to both Houses of Parliament by Command of Her Majesty.

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1894.

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Mr. J. B. Atkinson's Report.

REPORT of the INSPECTOR of MINES for the EASTERN DISTRICT of SCOTLAND for the Year ended 31st December 1893.—By J. B. ATKINSON, Esq.

PART I.

INTRODUCTION AND GENERAL RESULTS FOR THE YEAR.

10, Foremount Terrace, Glasgow,
24th February 1894.

SIR,

IN accordance with Section 43 of the Coal Mines Regulation Act, 1887, and Section 20 of the Metalliferous Mines Regulation Act, 1872, I have the honour, as Inspector in charge of the East of Scotland Mines Inspection District, to lay before you my Annual Report on the operation of these Acts during the year 1893.

Table I. gives the persons employed, tons of mineral raised, fatal accidents and deaths with respect to all the mines in the district during the year 1893.

TABLE I.

—	Persons employed.	Minerals raised.	Fatal Accidents.	
		Tons.	Number.	Deaths.
Mines under Coal Mines Regulation Act, 1887	53,236	17,272,735	60	62
Mines under Metalliferous Mines Regulation Act, 1872.	656	230,714	1	1
Total	53,892	17,503,449	61	63

This result is not unfavourable so far as loss of life is concerned; the number of persons employed and tons of mineral raised are both less than the corresponding numbers for the preceding year, but the fatal accidents and deaths have diminished in a still greater ratio.

PART II.

OUTPUT of MINERALS from MINES under both the COAL and METALLIFEROUS MINES REGULATION ACTS, arranged according to COUNTIES and GEOLOGICAL FORMATIONS.

Table II. shows the quantities of minerals raised from the different geological formations in the counties of which the district is made up.

TABLE II.

Counties.	Geological Formation.	Tons of Mineral raised.						
		Coal.	Fire-clay.	Ironstone.	Oil Shale.	Other Minerals.		Total.
						Tons.	Description.	
Clackmannan - -	Coal Measures -	410,409	3,142	—	—	—	—	413,551
Edinburgh - -	" " -	126,800	44,455	—	475	—	—	171,730
	Carb. Limestone	745,830	12,988	86,884	2,126	58,585	Limestone	906,413
	Calc. Sandstone	—	—	—	755,910	90,046	"	845,956
Fife and Kinross - -	Coal Measures -	1,240,612	4,559	—	—	—	—	1,245,171
	Carb. Limestone	2,380,894	43,365	9,383	—	48,500	Limestone	2,482,142
	Calc. Sandstone	—	—	—	5,014	7,602	"	12,616
Haddington - -	Carb. Limestone	333,101	1,377	—	—	—	—	334,478
Lanark (part of) -	Coal Measures -	7,321,814	10,634	25,218	30,566	3,883	Blaes	7,392,115
	Millstone Grit -	—	68,100	—	—	—	—	68,100
	Carb. Limestone	520,705	2,100	930	—	21,552	Limestone	545,287
	Calc. Sandstone	—	—	—	64,106	—	—	64,106
	Silurian - -	—	—	—	—	1,642	Lead ore	1,642
Linlithgow - -	Coal Measures -	469,855	10,525	36,989	—	—	—	517,369
	Carb. Limestone	261,555	—	14,428	—	2,787	Limestone	278,770
	Calc. Sandstone	—	—	—	1,061,034	—	—	1,061,034
Peebles -	Carb. Limestone	741	—	—	—	—	—	741
Stirling (part of) -	Coal Measures -	1,090,868	13,644	2,974	4,756	202	Ganister	1,112,444
	Millstone Grit -	3,187	33,762	—	—	9,255	"	46,204
Sutherland - -	Oolite - -	3,580	—	—	—	—	—	3,580
	Totals -	14,909,951	248,651	176,806	1,923,987	244,054	—	17,503,449

Table III. shows the total of the different kinds of mineral raised from the various formations.

TABLE III.

Geological Formation.	Tons of Mineral raised.						
	Coal.	Fire-clay.	Ironstone.	Oil Shale.	Other Minerals.		Total.
					Tons.	Description.	
Oolite - - -	3,580	—	—	—	—	—	3,580
Coal Measures - -	10,660,358	86,959	65,181	35,797	3,883 202	Blaes Ganister }	10,852,380
Millstone Grit - -	3,187	101,862	—	—	9,255	"	114,304
Carboniferous Limestone -	4,242,826	59,830	111,625	2,126	131,424	Limestone	4,547,831
Calciferous Sandstone -	—	—	—	1,886,064	97,648	"	1,983,712
Silurian - -	—	—	—	—	1,642	Lead ore	1,642
Totals - -	14,909,951	248,651	176,806	1,923,987	244,054	—	17,503,449

PART III.

SUMMARY of INFORMATION from ANNUAL RETURNS as to PERSONS employed and MINERALS raised, and as to FATAL ACCIDENTS for MINES under the COAL MINES REGULATION ACT.

Table IV. gives a summary of the information contained in the annual returns for the past year as to the persons employed and minerals raised at the mines under the Coal Mines Regulation Act in the district; the table is arranged in counties, except that three counties, Kinross, containing two mines, and Peebles, and Sutherland, each of which contains one mine only, are grouped together.

Table V. is partly a repetition of Table IV. with the fatal accidents and resulting deaths added, and gives the numbers of persons employed and tons of mineral wrought per fatal accident and death.

For the purpose of comparison the totals and averages for the two previous years are given in Tables IV. and V.

Counties.	Persons Employed. Underground. Males only. A. 12 to 16.	Above 16.	Total A.	Above ground at Pit. B. 12 to 13. Boys.	12 to 13. Girls.	13 to 16. Boys.	13 to 16. Girls.	Above 16. Females.	Above 16. Males.	Total B.	Total A. and B.	Above ground on private branch Railways, Washing and Coking Coal. C. 12 to 13. Boys.	12 to 13. Girls.	13 to 16. Boys.	13 to 16. Girls.	Above 16. Females.	Above 16. Males.	Total C.	Total A., B., and C.	Tons of Mineral raised. Coal.	Fire-clay.	Iron-stone.	Oil Shale.	Other Mineral.	Total.
Clackmannan	104	1,029	1,133	—	—	4	2	21	190	217	1,350	—	—	1	—	—	31	32	1,382	410,409	3,142	—	—	—	413,551
Edinburgh	279	4,522	4,801	4	—	77	—	—	1,045	1,126	5,927	2	—	20	—	—	85	107	6,034	872,630	57,443	86,384	758,511	—	1,775,468
Fife	1,044	8,504	9,548	3	4	93	82	287	1,347	1,816	11,364	2	—	13	20	5	468	508	11,872	3,619,530	47,924	9,383	5,014	—	3,681,851
Haddington	94	856	950	—	—	7	—	—	123	130	1,080	—	—	8	—	—	63	71	1,151	333,101	1,377	—	—	—	334,478
Kinross, Peebles, and Sutherland	1	46	47	—	—	—	—	1	12	13	60	—	—	—	—	—	1	1	61	6,297	—	—	—	—	6,297
Lanark, Eastern portion	2,091	17,471	19,562	7	1	341	27	101	2,902	3,379	22,941	1	—	26	—	5	434	466	23,407	7,812,519	80,834	26,148	94,672	3,883	8,048,056
Linlithgow	321	3,777	4,098	—	—	49	—	36	489	574	4,672	—	—	2	—	9	191	202	4,874	731,410	10,525	51,417	1,061,034	—	1,854,386
Stirling Eastern portion	463	3,208	3,671	3	—	11	3	92	344	453	4,124	—	—	10	—	14	307	331	4,455	1,094,055	47,406	2,974	4,756	9,457	1,158,648
Totals	4,397	39,413	43,810	17	5	582	114	538	6,452	7,708	51,518	5	—	80	20	33	1,580	1,718	53,236	14,909,951	248,651	176,806	1,923,987	13,340	17,272,735
Ditto preceding year	4,644	39,502	44,146	11	—	665	113	587	6,590	7,966	52,112	2	2	73	11	46	1,456	1,590	53,702	15,718,976	255,659	167,793	2,054,795	13,646	18,210,899
Ditto 1891	4,587	38,020	42,607	11	9	662	98	571	6,280	7,631	50,238	1	—	79	3	39	1,389	1,511	51,749	14,763,193	257,097	143,639	2,311,592	14,235	17,489,756

TABLE V.—SUMMARY of Persons employed, Mineral raised, Fatal Accidents, and Deaths at Mines under the Coal Mines Regulation Act, 1887, during the Year 1893.

Counties.	Persons employed. At Pit. Under-ground. A.	At Pit. Sur-face. B.	At Pit. Total. A. and B.	On Rail-ways, &c. C.	Total A., B., and C.	Tons of Mineral raised.	Fatal Accidents and Deaths. At Pit. Under-ground. A. No.	Under-ground. A. Lives lost.	Surface. B. No.	Surface. B. Lives lost.	Total. A. and B. No.	Total. A. and B. Lives lost.	On Rail-ways, &c. C. No.	On Rail-ways, &c. C. Lives lost.	Total A., B., and C. No.	Total A., B., and C. Lives lost.	Persons employed per fatal Accident and Death. Per fatal Accident. At Pit. Under-ground. A.	Sur-face. B.	Total. A. & B.	On Rail-ways, &c. C.	Total A., B., & C.	Per Death. At Pit. Under-ground. A.	Sur-face. B.	Total. A. & B.	On Rail-ways, &c. C.	Total A., B., & C.	Tons of Mineral raised. Per fatal Accident. A. and B.	Per Life lost. A. and B.
Clackmannan	1,133	217	1,350	32	1,382	413,551	1	1	—	—	1	1	—	—	1	1	1,133	—	1,350	—	1,382	1,133	—	1,350	—	1,382	413,551	413,551
Edinburgh	4,801	1,126	5,927	107	6,034	1,775,468	13	14	1	1	14	15	1	1	15	16	369	1,126	423	107	402	343	1,126	395	107	377	126,819	118,365
Fife	9,548	1,816	11,364	508	11,872	3,681,851	14	14	3	3	17	17	—	—	17	17	682	605	668	—	698	682	605	668	—	698	216,579	216,579
Haddington	950	130	1,080	71	1,151	334,478	1	1	—	—	1	1	—	—	1	1	950	—	1,080	—	1,151	950	—	1,080	—	1,151	334,478	334,478
Kinross, Peebles, and Sutherland	47	13	60	1	61	6,297	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Lanark, Eastern portion	19,562	3,379	22,941	466	23,407	8,048,056	16	17	3	3	19	20	—	—	19	20	1,223	1,126	1,207	—	1,232	1,151	1,126	1,147	—	1,170	423,582	402,403
Linlithgow	4,098	574	4,672	202	4,874	1,854,386	4	4	—	—	4	4	—	—	4	4	1,024	—	1,168	—	1,218	1,024	—	1,168	—	1,218	463,596	463,596
Stirling, Eastern portion	3,671	453	4,124	331	4,455	1,158,648	3	3	—	—	3	3	—	—	3	3	1,224	—	1,375	—	1,485	1,224	—	1,375	—	1,485	386,216	386,216
Totals and averages	43,810	7,708	51,518	1,718	53,236	17,272,735	52	54	7	7	59	61	1	1	60	62	842	1,101	873	1,718	887	811	1,101	845	1,718	859	292,758	283,160
Ditto preceding year	44,146	7,966	52,112	1,590	53,702	18,210,899	60	60	6	6	66	66	5	5	71	71	736	1,328	790	318	756	736	1,328	790	318	756	275,923	275,923
Ditto 1891	42,607	7,631	50,238	1,511	51,749	17,489,756	67	68	10	10	77	78	3	3	80	81	636	763	652	504	647	627	763	644	504	639	227,140	224,228

Table VI. shows the variation between last year and the year 1892 in the different counties composing the district in respect of persons employed, minerals worked, fatal accidents and deaths; an increase is shown by the sign + and a decrease by the sign —

TABLE VI.

County.	Persons employed A. B. & C.	Tons of Mineral.						Fatal Accidents.	
		Coal.	Fire-clay.	Ironstone.	Oil Shale.	Other Mineral.	Total.	No.	Deaths.
Clackmannan	+ 15	− 2,080	+ 332	—	—	—	− 1,748	*	*
Edinburgh	−363	−56,091	+23,801	+14,589	−45,377	—	−63,078	− 2	− 1
Fife	+122	+45,712	+10,306	− 5,252	−104,825	—	−54,059	− 1	− 1
Haddington	+ 27	+36,106	− 6,149	—	—	—	+29,957	+ 1	+ 1
Kinross, Peebles, and Sutherland.	− 80	−12,831	—	—	—	—	−12,831	*	*
Lanark, Eastern portion	+ 14	−708,449	−22,845	− 7,339	− 9,666	− 1,705	−750,004	−11	−10
Linlithgow	−319	−47,166	− 7,537	+ 5,757	+28,722	—	−20,224	*	*
Stirling, Eastern portion	+118	−64,226	− 4,946	+ 1,258	+ 338	+ 1,399	−66,177	+ 2	+ 2
Totals	−466	−809,025	− 7,038	+ 9,013	−130,808	− 306	−938,164	−11	− 9

* Same as last year.

While it is not possible to state with any degree of accuracy the numbers of persons engaged respectively in the production of coal, fire-clay, ironstone, oil shale, and other minerals from the coal measures, the millstone grit and carboniferous limestone measures, as these minerals are frequently worked together from the same seam, the persons employed in the production of oil shale from the calciferous sandstone series can be given, and owing to the depressed state of the oil trade there was a reduction of 645 persons so engaged during last year as compared with 1892; this number shows that 179 more persons were employed in the other mines.

With a small increase in the number of persons employed in coal mining in the district there is the large reduction of the output of 809,205 tons. This is due to two causes, first, a dullness in trade during the first six months of the year, and second to two strikes, one in the coalfield north of the Forth in August and September and another in the coalfields south of the Forth in November and December, each stoppage lasting fully a fortnight. Had it not been for these strikes it is probable that the output of coal would have been nearly the same as that for the year 1892, as when the strikes took place there was an excellent demand for coal due to the great strike in England.

PART IV.

FATAL ACCIDENTS at MINES under the COAL MINES REGULATION ACT.

During the year 1893, 60 fatal accidents, causing the deaths of 62 persons, took place in connexion with mines under the Coal Mines Regulation Act, 1887. Of this number 52 occurred underground (head A), causing 54 deaths; 7 occurred on the surface at the mines (head B), and 1 occurred on a private branch railway (head C.) This is a reduction of 11 accidents and 9 deaths as compared with the previous year.

These fatal accidents are all tabulated together in Appendix A. In my previous reports the accidents to persons employed underground and on the surface at the mines were given separate from those to persons employed on private branch railways and in washing and coking of coal. Previous to the year 1888, these latter accidents were not included in the Summaries; from 1888 to 1892 they were given separately and did not appear in the principal tables. In future they will be included.

Explosion of Fire-damp.—One life was lost through an explosion of fire-damp. This accident, No. 51, Appendix A (*see* also No. 33 Table VIII.), occurred in Fife, a part of the district in which fire-damp is rarely observed.

The explosion took place at the top of a self acting incline in the Five Feet Seam of No. 7 Pit, Cowdenbeath Colliery; the seam has an inclination of 1 in $2\frac{1}{2}$, and is worked longwall. Gas had been seen in the section occasionally during nine months previous to the accident, and was seen by the fireman when making his inspection on the day of the accident before the entry of the workmen; the place in which the injured man worked, which was the highest level, was found clear of gas but the heading or place above the wheel contained gas,

and as the fireman allowed deceased and another miner to proceed to their work with naked lights they ignited this gas when engaged near the wheel preparing for the running of hutches. The fireman stated he had forgotten that the miners would require to approach the place where the gas lay. He was charged before the Sheriff with a breach of Special Rule 38, which provides for the examination by the fireman of working places, and the course to be pursued in the event of gas being found, he pled guilty and was fined 2*l.* on agreeing to subscribe 3*l.* to Edinburgh Royal Infirmary. (*See* No. 32 prosecution, Table X.)

The accident took place on the 13th November, and deceased was removed, on serious symptoms appearing, to the Edinburgh Royal Infirmary, on the 29th November, where he died a day or two after admission. It is not improbable that had he been taken to the infirmary at once he would have recovered.

Falls of Roof and Side.—Twenty-nine separate accidents caused the loss of thirty-one lives. Careful inquiry and inspection of the place was made in each case. None of them was caused by the want of loose timber to set, if thought necessary. Most of them were caused by natural breaks or partings in the strata, often unseen, relieving masses of mineral. All miners know that occasionally the apparently strongest roofs and sides give way, and it is a question whether this possibility should not be guarded against by the enforcement of systematic propping.

Table VII. shows the occupation of the persons killed, and some of the conditions under which the accidents took place.

TABLE VII.

Occupation of Persons killed.	Fatal Accidents at Face.						Fatal Accidents on Roads.			
	Longwall.		Solid Place.		Stooping.		Through Longwall Waste.		Through Stoops.	
	Roof.	Side.	Roof.	Side.	Roof.	Side.	Roof.	Side.	Roof.	Side.
Miner	5	4	1	3	4	—	—	—	3*	—
Brusher, repairer	3	—	—	—	—	—	—	—	1	—
Fireman	—	—	—	—	—	—	—	—	1	—
Horse driver	—	—	—	—	—	—	—	—	1	—
Roadsman	—	—	1†	—	1	—	—	—	—	—
Drawer	—	1	—	—	—	—	—	—	—	—
Totals	8	5	2	3	5	—	—	—	6	—

* Two of these accidents each caused the loss of two lives.
† Near face of stone mine.

Three fatal accidents due to falls, the investigation of which led to the disclosure of breaches of the law, will be specially noticed.

No. 1, Appendix A.—This accident, resulting in the loss of two lives, occurred on a main haulage road over which the hutches were led by means of an endless rope, moving at a speed of about two miles per hour. A bogie, provided with clips for gripping the rope, preceded the rake. The road dips inbye, and snibbles were placed in the wheels of some of the empty hutches. An attendant rode on the bogie, but the miners were not allowed to ride on it or on the rake, and notices to that effect were posted up near the shaft bottom.

At the time of the accident an empty rake of 12 hutches was being drawn inbye, and in these hutches the deceased men and others were riding. At a steep part of the road the hutch next the bogie left the rails; the attendant noticed this and at once detached the bogie from the rope, but the rake continued to move, although the hutches were snibbled in the usual way; he attempted to stop the rake by placing his back against the bogie, but was unsuccessful, and the hutch that was off the rails displaced some timber supporting the roof and relieved some stone which fell upon the hutch in which the deceased men were riding.

The under-manager was charged before the Sheriff with not enforcing the rule against riding in the hutches, but the charge was not maintained. (*See* No. 7 prosecution, Table X.)

No. 7, Appendix A.—This accident took place in a "Break Incline," which was in course of formation in the Corbie coal workings. The seam is 7 feet 3 inches in thickness, has a dip of 58 degrees, and is worked "Stoop and Room," the stoops being 30 feet in thickness, measured on line of dip, and the rooms or levels 9 feet in width. Upsets 4 feet by 3 feet

6 inches had been driven from each level to the one above by the miners in the ordinary course of working, until the top of the "fetch" of 54 fathoms was reached. The work of stripping the incline to the required width and height, setting the permanent timber, laying the rails, and generally completing the incline, was then let to a contractor, who took upon himself all responsibility in connexion with the regular inspection of the incline, and the safety of the workmen employed upon it, and therefore the regular fireman ceased to inspect it in terms of General Rule 4 (i). It was stripped from the top downwards, and when the accident took place it had been completed and the timber set to a point about 17 fathoms from the bottom. The deceased were engaged at this point, when about 20 tons of coal and blaes suddenly burst from the roof near the top of the incline, swinging the props and crowns which had been set under it. The debris swept down the incline, crashing through nine scaffolds on its way, and buried the deceased, killing them instantly.

Proceedings were instituted against the manager (1) for failing to appoint a competent person to examine the incline before the commencement of the shift, as required by General Rule 4 (i); and (2) for failing to see that the results of such examination were forthwith recorded in a book kept at the mine for this purpose. He pled guilty to the second charge, and was fined in five pounds. (*See* No. 11 prosecution, Table X.)

No. 15, Appendix A.—This accident was caused by a fall of coal, and shows that although the rule as to spragging is faithfully carried out, accidents may occur. Deceased and his son worked together, and, as is usual in the district, left their place holed and the coal well secured with "gibs" on the Saturday previous to the accident. Between Saturday and Monday morning the coal had broken at the back of the holing and rested on the gibs. Deceased was engaged "mending" the holing, while, at the same time, the man who occupied the place to the left was holing out a "gavel" or unholed piece of coal at the march between the places. As soon as the gavel was out, the coal fell along the face, and deceased was so severely crushed that he died from his injuries a week afterwards. The gibs or sprags were sufficient to keep up the coal so long as the gavel was in, but immediately it was removed, they were no longer able to sustain the weight of the coal. While making inquiry into this accident Mr. McLaren discovered that some of the men were in the habit of going to their working places without first having received a report from the fireman that it was safe to do so, in contravention of General Rule 4 (i), and Special Rules 67 and 68, and the prosecutions, Nos. 16 and 17, in Table X. resulted.

In Shafts.—Eight fatal accidents in shafts caused as many deaths.

No. 2, Appendix A.—Deceased and another labourer named Patrick Cassidy were engaged in sending down fodder in hutches from the low scaffold, or surface level, to the Splint Coal. A pair of cages ran in the shaft, but only the rise cage was used for this purpose, and the engineman placed it in position at the low scaffold, where no shuts were in use, by observing the position of the crosshead of his right-hand engine. Coal was being raised at the time, and when a hutch of fodder was ready, deceased called to the engineman, who lowered the cage containing an empty hutch from the high scaffold to the low scaffold, where the empty hutch was taken off and replaced by a hutch of fodder; deceased then cried "There," and the engineman lowered the cage to the bottom.

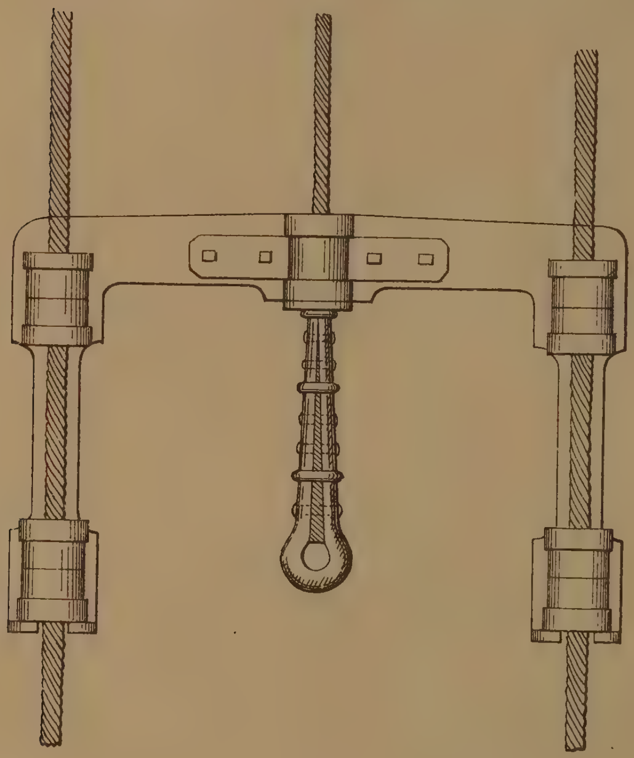
When the fifth hutch of fodder was ready, the cage was called for and was lowered to the low scaffold, but brought to rest about four inches too high. This did not prevent the removal of the empty hutch, but when deceased and Cassidy attempted to push on the hutch laden with fodder they found they could not accomplish it. Deceased then, according to Cassidy's statement, called to the engineman, "Lower a wee bittie;" they continued to push the hutch forward, the cage was lowered to the bottom of the shaft, and as it left the low scaffold the hutch fell into it and rested on its end; Cassidy fell with it, but caught the crossbar of the cage and arrived safely at the bottom; deceased was found lying in the cage dead, having evidently been crushed against the side of the shaft.

The engineman, who was a steady and experienced man, stated he received a cry for the cage, and lowered it to the low scaffold, and then received the cry "There," on which he lowered the cage to the bottom, and was not aware of any accident having happened until informed by the manager some little time after.

No. 4, Appendix A.—This accident took place in a shaft 20 feet in diameter, which was being sunk at Newbattle Colliery. A feature in this sinking was the use of a permanent double-decked scaffold suspended on steel cables, from which the shaft sides were walled while sinking was proceeding below. Two large kettles running between the surface and the bottom passed through an opening in the centre of the scaffold, and loose riders, sliding on the cables suspending the scaffold, accompanied and steadied these kettles while they ran

NEWBATTLE. ELEVATION OF RIDER.

Scale - 1 inch = 1 foot.



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J. B. Atkinson

between the surface and the scaffold. A third and smaller kettle travelled between the surface and the scaffold for the use of the wallers, a loose rider (*see* plate) also moved with this kettle, sliding on the two parallel parts of a rope which passed round a sheave (to which a pump was attached), below the scaffold. The accident was caused by the rider of the small kettle sticking on the guide-ropes, and afterwards falling away, while deceased was descending on the kettle.

At the time of the accident the shaft was 165 fathoms deep and the scaffold was hanging 35 fathoms from the bottom.

The master sinker and deceased left the surface together, standing on the rim of the kettle. The former had no light, deceased had a lighted lamp in his hat when he commenced to descend, but it was extinguished before they arrived at a point 64 fathoms from the surface where the master sinker got off the kettle to attend to a pump stationed there and illuminated by an electric lamp, which enabled him to see that when deceased commenced to descend lower on the kettle the rider was following in the usual way, resting on the socket of the winding rope.

The engineman who was lowering the kettle felt a sudden shock on the rope when it was within five fathoms of the scaffold ; he at once stopped the engine. Some men were working on the lower deck of the scaffold, and they heard deceased and the rider fall on to the upper deck. The rider was still attached to the guide-ropes, but the hole in it through which the winding rope passed had broken open and allowed it to fall past the kettle.

No. 12, Appendix A.—This accident occurred in a shaft in which coal is drawn from the Upper Drumgray seam at 58 fathoms, and from the Lower Drumgray seam at 65 fathoms. The winding drum has two diameters, so that a cage runs to each seam. Deceased was employed as a boiler fireman, and during the shift he took a loaded tub of coal off the cage at the surface level or low scaffold from the Upper Drumgray side of the shaft. After giving the engine-keeper the signal that all was right, he ran it to the boiler fire-hole, situated 30 yards to the north of the shaft. The engine-keeper then lowered the cage so as to bring up the Lower Drumgray cage, and allow some men on the pithead to descend to the Lower Drumgray seam. After emptying the tub of its contents, deceased returned with it to the shaft, and, evidently forgetting that the cage was away, pushed it into the shaft and was precipitated with it to the bottom. The shaft was properly fenced at the surface level by bars of wood fitting into wooden sockets.

No. 24, Appendix A.—Deceased was engaged at the bottom of a small pit, 55 feet deep, which was being sunk to form an outlet from a seam which lay at a further depth of about 10 feet. The debris was raised in kettles, 1 foot 10 inches square by 1 foot 6 inches deep, which were attached to a 1 inch diameter hemp rope by means of ordinary spring hooks. The rope coiled upon a windlass barrel 9 inches in diameter, placed 3 feet $9\frac{1}{2}$ inches above the pitmouth. The kettles were not detached from the rope at the pitmouth, consequently, to permit of their being emptied clear of the shaft, several feet of slack rope required to be paid out. This frequently caused the hook in the pit bottom to twist on the bow of the kettle, and care had to be taken to see that it and the rope were hanging properly before each kettle was sent away.

Deceased filled and sent away a kettle of debris, apparently without observing that the hook was twisted, and as the night was dark the windlassmen failed to see it. The circular link connecting the rope and the hook came up edgewise against the windlass barrel, on touching which it suddenly twisted round upon its side, and the consequent jerk detached the kettle from the spring hook. The windlassmen shouted to warn deceased, but before he could get clear, the kettle fell upon him, fracturing his skull and killing him instantly.

No. 25, Appendix A.—Deceased was employed as bottomer in a pit 33 fathoms deep. While stooping to turn down the hutch guard on a cage which had just landed in the pit bottom, a piece of coal, which had apparently fallen from the newly ascended cage when it was set back upon the shuts at the pitmouth, fell down the shaft and struck him on the back of the head, causing a compound fracture of the skull.

No. 26, Appendix A.—This accident took place in the same pit as did accident No. 4, and was also caused by the fall of the rider of the small kettle, but under different circumstances.

The shaft was sunk 185 fathoms at the time, and the walling scaffold was hung 25 fathoms from the bottom. Some rhones or water boxes were to be fixed to the side of the shaft,

beginning 30 fathoms above the scaffold and extending some distance below it. The rhones were fastened at the surface to the rope of the small kettle, and the rider rested on a gland screwed to the rope 31 fathoms from the hose or socket, the rhones were then lowered into position and secured to the shaft side by workmen working from one of the large kettles, the rider of which was made fast at the surface so as to allow the kettle to be deflected from the perpendicular.

When this work was finished the rope was detached from the rhones and the saddle hung on to the end, deceased got on to it and was signalled to the surface, the rider still resting on the gland 31 fathoms above him; after ascending about 30 fathoms the rider fell away, knocked deceased off the saddle and fell with him on to the walling scaffold.

No. 28, Appendix A.—Deceased and a number of other workmen had gathered at the pit bottom at the close of their shift, and were waiting their turn to ascend. The dip cage had been sent up with both of its decks loaded with men. The engineman, in accordance with the regular custom at the pit, stopped it with its upper deck level with the plates at the pithead, thus setting the lower deck of the rise cage level with the plates at the pit bottom. Deceased forthwith stepped upon this cage without waiting for the bottomer's permission, and before any one could see his intention or stop him. Some of the workmen shouted to him to come off until the cage was lowered and its upper deck set level with the plates. He attempted to do so, but was caught by the cage, his head being crushed between its upper deck and the plates of the landing, and his skull fractured.

The winding spaces in both sides of the shaft at the pit bottom were fenced with horizontal bars of iron, hinged at one end. The accident would have been prevented had the fencing bar on the rise side not been raised until the cage was properly set. Deceased had only been employed underground for about six weeks.

No. 55, Appendix A.—This accident took place in an old shaft which was being re-opened. A lift of pipes had been put in, and the crane rope had been left attached to the uppermost pipe about three feet below the pitmouth. Deceased and another sinker had subsequently been engaged in repairing the midwall, and had come up for breakfast, leaving the scaffold on which they had been working hanging on the engine rope, a few feet below the pitmouth. The engineman then pinned down the lever of the brake upon his winding drum, threw the drum out of gear, and set the engine running to fill up the boilers. Deceased having finished breakfast, wished to use the crane rope for some purpose, and without informing the engineman of his intention, leaped down upon the scaffold in order that he might reach and disengage the crane sling. The consequent jerk on the winding rope caused the brake to slip, and the scaffold dropped smartly for a few feet. The underground fireman was in the engine-house at the time; he threw his weight upon the brake lever and at once stopped the drum. Owing to its sudden stoppage, or to a corner of the scaffold having caught on a bunton, it tilted, deceased slipped off, and fell a distance of about 13 fathoms into the water which was standing in the shaft. He is believed to have struck some floating timbers which caused a fracture of his left thigh and a flesh wound on his right leg. He died the following day.

Miscellaneous Underground.—Under this heading 14 fatal accidents, causing the same number of deaths occurred. Seven were "on inclined and engine planes," one by "trams and tubs," and six by "sundries underground."

No. 6, Appendix A.—This accident occurred at the foot of a "gurdy brae" or self-acting incline, 15 yards in length, and with an inclination of one in three. Deceased was employed as a dook-footer at an incline of 240 yards outbye, and in addition to his duties there ran the tubs between both inclines. Although no part of his duty, he attached an empty tub to the chain at the foot of the gurdy brae and signalled it away; when about halfway up the draw bar of the empty tub broke, and both tubs descended the brae, and before deceased could get out of the way he was struck by the loaded tub and crushed against the side. The drawbar broke at the first bolt hole; the break on one side of the hole was an old fracture, which, however, could not be easily seen as the nut partly covered it.

No. 18, Appendix A.—Deceased, who was somewhat infirm, and said to be rather deaf, was run down by five loaded hutches on a portion of road about 40 or 50 yards long, inclining outbye, and lying between the horse road and the engine lye. The horse rakes ran by gravity over this section of road, and the first rake going to make up the engine rake of 24 hutches was not snibbled so as to allow it to occupy the outer end of the lye. The rake which caused the accident was the first rake run that day, and as usual it was not snibbled; it had attained a speed of about eight miles an hour at the point where it ran into deceased, who was coming

inbye. The driver was behind the rake, and he saw that deceased was in danger and called to him, and at the same time held on to the last hutch, but was unable to stop the rake. There was no manhole on this portion of the road, nor, unless it could be termed self-acting, was any required by law. At the same time it was a road that should either have been provided with some place of refuge or travelling prohibited on it. The manager agreed to adopt the latter course.

No. 19, Appendix A.—Deceased signalled away a rake consisting of an empty hutch (permanently attached to the rope and called the chain hutch) and two hutches loaded with oil shale, from a platform on a dook dipping one in three, the haulage on which was performed by a steam engine on the surface working a single rope. When the rake started, and as it was passing round the curve at the bench, it left the rails and crushed deceased against a tree, which was displaced and caused a heavy fall of roof; the fall of roof did not, however, cause death, as deceased was clear of it. The attendant or chain runner whose duty it was to signal away the rakes was higher up the dook at the time; the rope had been taken down by the chain hutch, which had been derailed, and the chain runner after lifting it on to the rails had signalled it down, he remaining at the place to adjust the rails.

No. 20, Appendix A.—For some distance from the shaft bottom the haulage road on which this accident happened is flat, and required the use of both a main and tail rope; beyond the flat portion the road dipped inbye, where only the main rope was required. At the inner end of the flat portion of road was a return sheave for the tail rope, the empty rake was stopped here, the tail rope taken off, and the rake then ran in by gravity, taking the main rope with it, the speed being controlled by the brake on the main rope drum, which revolved loose on the shaft. The ordinary rake was 15 hutches. Ten hutches loaded with stone were brought to the shaft from another part of the mine, and were, along with five empties, taken inbye by the engine along the road on which the accident occurred. The stone contained in the ten hutches was to be stowed in the workings. The engineman was informed that ten hutches loaded with stone were on the rake, but he stated he was not informed that five empties were added. The engineman intended, when he stopped the rake at the tail rope sheave, to fix the main rope drum to the shaft so that he could control the speed of the rake, which was heavier than usual, by the engine as well as by the brake. Unfortunately when the rake reached the tail rope sheave he was unable to stop it and it ran past the sheave, broke the tail rope, and ran amain down the inclined part of the road. He then attempted to fix the main rope drum, which was revolving rapidly, to the shaft but was unsuccessful, he then applied the brake, but was unable to check the rake, which ran at a high speed, until a junction was reached, where it left the rails, and the hutches were thrown in all directions.

A fireman and a contractor were coming outbye and had arrived at the junction, where they were caught by the hutches. The contractor was killed and the fireman slightly injured.

No. 21, Appendix A.—Deceased was in charge of a horse which was employed in drawing the sets of empty tubs inbye over a flat portion of an engine dook. At the inbye end of this flat portion he uncoupled the horse and turned it aside into an old road-end, and, assisted by a drawer, pushed the tubs as they passed him until the increasing inclination of the road enabled them to pull out the engine rope. The horse became restive and pushed him against the tubs, which jammed him against the stoop corner. The drawer went to his assistance, when the horse again backed violently against deceased, fracturing his ribs and driving them into his lungs.

No. 23, Appendix A.—Deceased was engaged cleaning a wheel brae which was 76 fathoms in length, and had an average gradient of about one in one and three-quarters. When he was about the centre of the brae a stone fell from the roof or side near the top, rolled down, and struck him on the head, fracturing his skull.

No. 27, Appendix A.—Deceased, a roadsman, was crushed by the descending carriage on a dook extending from the surface and inclined at about 34 degrees. He was descending on foot from No. 8 to No. 9 bench. From No. 8 to No. 10 bench canvas brattice was carried down the dook, and behind this brattice there was ample room for any person to pass clear of the carriage, but deceased travelled on the carriageway. There were no manholes in the dook between Nos. 8 and 9 benches, and it was a question with me whether this was a contravention of General Rule 14, which provides that "Every underground plane on which "persons travel, which is . . . worked by an engine . . . shall be provided . . . "with sufficient manholes for places of refuge, at intervals of not more than twenty yards." This dook was ordinarily traversed by the miners and others on the carriage, and only on special occasions was it travelled on foot. Deceased could have had the use of the

carriage had he desired it. Under the circumstances I did not advise a prosecution. At the same time I would point out to managers that on any such road which is ordinarily travelled on foot, even if only by officials, manholes are necessary in order to comply with the General Rule quoted.

No. 29, Appendix A.—This accident was caused by the slipping from its place of a bar or crown, 9½ feet long by 7 inches square, put in for the support of the roof and sides of a carriage and pumping dook, lying in the Kailblades seam and inclined at 30 degrees. After falling out the bar slid 40 fathoms to the foot of the dook. The dook is about 9 feet by 6 feet sectional area. The bar had been notched into the coal sides, and the side pressure usually fixed such bars firmly, but in this case the coal supporting the ends of the bar must have fallen away and the side pressure had not been applied.

The empty carriage was descending at the time for the miners who were congregated at the dook foot. The carriage was derailed at the place from which the bar fell, but whether this caused the fall or was the effect of it, could not be determined.

Deceased was climbing on to the dook from a side entrance, two or three feet below the floor of the dook just as the bar arrived at the point, and he was killed instantly.

The dook was examined daily by the officials, all of whom traversed it on the carriage, from which they could see the whole of it, but no danger had been observed.

No. 32, Appendix A.—Deceased worked at the foot of a dook, which extends for a distance of about 50 fathoms from the pit bottom, and has an average dip of one in five. The tubs are drawn up one or two at a time by an open ended rope worked by an engine at the dook head; no one was permitted to ride on the tubs or travel on the dook behind the loaded set. Contrary to this regulation, deceased had travelled up behind two loaded tubs for a distance of about 15 yards, when the tubs ran back upon him, owing to a rivetted muzzle pin in the coupling chain, by which they were attached to the rope, having given way. Deceased slipped and fell between the rails, and the tubs ran over him, fracturing his ribs and crushing them into his lungs. There was a fork 3 feet 1 inch in length attached to the rear coupling of the second tub, but it failed to hold or derail them in time to save him.

No. 43, Appendix A.—The accident took place on a dook which extends for about 57 fathoms from the pit bottom. The gradient varies between one in three and one in six, and the tubs are drawn up in sets of two by an open ended rope worked by an engine on the pithead. A wire is stretched along the centre of the dook, by means of which signals can be made from any part of it to the pit bottom, and the bottomer there repeats any signals received to the engineman at the pithead. Deceased was employed by his stepfather, and had only commenced to work in the dook on the night on which the accident occurred. He was instructed by the fireman to travel up and down the dook with each set of tubs, in order that if they left the rails he could at once signal to the bottomer and have the engine stopped. When coming up in front of his first loaded set his head came in contact with a low crown, which knocked off and extinguished his lamp. He tried to catch the signal wire to stop the set, but tripped and fell in front of it, and was severely crushed between the tubs and the side of the dook. He died on the same day.

The practice of travelling upon an engine plane having such a gradient while the tubs are in motion is an exceedingly dangerous one. The attention of the owners was called to it, and they agreed that it should be discontinued forthwith.

No. 47, Appendix A.—This accident was caused by the descending empty carriage on an incline, from the surface, dipping from one in one and a half to one in three, striking deceased while he was ascending on foot. The carriage ran on rails laid to a gauge of 3 feet 6 inches; it held three hutches, and weighed about 30 cwt. The incline was not used as a travelling way, all persons traversing it on the carriage. A companion incline was used as a travelling way, which deceased should have used, but it appeared that he did not expect the carriage to descend below a bench to which he was proceeding and from which he intended to ride to the surface on the carriage. The carriage called at several benches, and on the occasion of the accident the engineman was in doubt where it was next required, and he allowed it to run past the bench deceased was climbing to.

No. 50, Appendix A.—Deceased drew coal from the face of a level in the Peacock Tail Seam to the brake incline, a distance of about 200 yards. The level was 40 yards from the bottom of the incline, which was very steep, from 60 degrees to 70 degrees. The incline was worked by a carriage and back balance in connexion with a drum at the top of the incline.

At the entrance to the levels the signal lever was so arranged that when lowered it extended across the level and acted as a fence; each lever was connected with a separate hammer fixed

near the drum. It appeared that the levers were not used either for signalling or as a fence; the signalling was done by cries from the levels to the brakesman.

Deceased left the face of the level, pushing a loaded hutch. He ran it into the incline and fell with it. The hutch fell on to the carriage, which was at rest a few feet from the bottom of the incline, but deceased fell to the bottom into a small sump about four feet deep and filled with water, where he lay for 15 minutes. A boy near the foot of the incline heard the fall and raised the alarm, but not much attention was paid to it, and as he could not see deceased it was not then known that anything serious had occurred. On deceased being extricated from the sump he was dead. He was much injured by the fall, but, probably, the immediate cause of death was drowning.

No. 52, Appendix A.—This was a singular case, and perhaps should not have been classed as an accident. Deceased was employed as bottomer at a shaft. He was an aged and not a healthy man. He left his post at the shaft bottom about 9 a.m. on the 14th November, and it was understood by persons there that he had gone to a small ventilating furnace at the bottom of another shaft, about 100 yards away, to warm himself. There was another shaft still further away, fitted with ladders to the surface, and the road to this shaft coincided for a considerable part of the distance with the road to the furnace. He did not return to his work, and search was instituted the same day and on several succeeding days, but he could not be found, and it was supposed he had climbed the ladder shaft to the surface. Search and inquiry made on the surface led to no result, and search was recommenced underground, and, eventually, on the 2nd December, his body was found about 90 yards from the furnace in the return air way, or rather in a confined road next the rib side adjacent to the return air way.

A post-mortem examination was made and his heart was found to be diseased.

The probable explanation seemed to be that he had lost his way and, in his confusion, he had crawled to the point where he was found and died from heart disease.

No. 56, Appendix A.—This accident took place in a brake incline which is about 40 fathoms in length, and has an inclination varying between 65 degrees at the top of the incline and 97 degrees near its foot. The loaded tubs are placed, one at a time, upon a carriage which runs on one side of the incline, and are lowered to the horse road at its foot; the weight of the loaded carriage raising a back balance which runs on the other side of the incline, and which in descending again raises the carriage bearing an empty tub. Owing to the varying inclination the loaded carriage occasionally stops, especially if the tub upon it has not been sufficiently loaded.

Deceased had come outbye with a loaded tub, which, when placed upon the carriage, proved to be too light to take it down. The brakesman and a drawer, observing this, stepped out upon the incline, and, by pulling down the rope, kept the carriage in motion for a distance of about 13½ fathoms. They then shouted for further assistance, and deceased, knowing that his tub was on the carriage, ran forward to assist. On reaching the incline he tripped or slipped over the bench, and fell headlong down upon the carriage, breaking his neck.

The entrance to the incline was fenced by a horizontal bar, as is usual at the colliery, but when going out on the incline the brakesman had pinned up this bar in order that it might not impede his return to the brake lever when the carriage began to move away again.

The brakesmen and drawers are forbidden to go upon the incline under any circumstances. A strict compliance with this regulation would prevent many accidents in these edge workings.

Aboveground.—Seven fatal accidents, causing seven deaths, occurred on the surface at the mines (head B.), and one accident, causing one death, on a private branch railway (head C.).

No. 11, Appendix A.—This accident, which was witnessed by the manager of the colliery, was caused by the dangerous practice of using a prop to sprag a railway waggon. Four empty waggons were beginning to move down an incline of about 1 in 12, when deceased snatched a prop five feet long from a stack of timber and attempted to insert it between the spokes of one of the waggons, but not entering it far enough it was twisted out by the guard of the wheels and pressed flat against the body of the waggon; deceased was either jammed between the prop and the waggon or he received a blow. He eventually fell across the rails and the next waggon passed over him. The manager, knowing the danger of using long props for spragging waggons, shouted to him to desist, but deceased, who may not have heard, continued his attempts, with the result stated.

No. 14, Appendix A.—Deceased was in charge of a horse which was pulling six empty waggons down a slight incline to the screens. When near the screens he attempted to pass

below the tail chain of the horse while the waggons were moving, he slipped and fell and the four wheels on one side of the first two waggons passed over his left leg.

No. 17, Appendix A.—This accident took place in one of a battery of five Lancashire boilers, each 30 feet in length and 8 feet in diameter, and made to work under a steam pressure of 100 lbs. per square inch. Each boiler was furnished with a 3 inch diameter "blow-off" or sludge pipe, fitted to the bottom of the boiler close to its front, and connected at right angles to a main sludge pipe 4 inches in diameter, which passed along the front of the boilers and discharged into a brick culvert 2 feet wide by 2 feet 10 inches high.

On the evening prior to the accident, the engineer in charge blew off No. 2 boiler in order that deceased might clean it on the following day. On returning to work next morning he commenced to prepare No. 4 boiler for blowing off. Deceased assisted him to screw down the crown valve and to lift the safety valve. When the steam pressure had been reduced to 70 lbs. the engineer went to open the sludge cock, and, unknown to him, deceased entered No. 2 boiler by the sludge door. The boiling water and steam from No. 4 boiler, in passing along the main sludge pipe, dammed back through the open sludge cock into No. 2 boiler, filling it with steam and scalding deceased to death.

To lessen the risk of similar accidents, it was suggested that each sludge pipe should be led separately to the culvert. The manager approved of this and gave effect to it.

No. 35, Appendix A.—Deceased, a labourer, was killed by being run over by a waggon half full of coal, which was being pushed forward by a locomotive engine, which was at the same time drawing three empty waggons. The noise from shaking screens and travelling belts was considerable, and deceased appeared not to have heard the waggons. The driver of the locomotive saw that deceased was in danger and he blew the whistle and the shunter applied the brake, but the wheels skidded, and deceased was run over by the waggon preceding the engine.

No. 48, Appendix A.—Deceased was employed as a locomotive shunter. The locomotive engine pushed ten empty waggons and nine waggons loaded with dross, into a spare lye, where the loaded waggons were to remain; they were uncoupled by deceased, and the empty waggons were drawn away by the engine. The loaded waggons commenced to move in the same direction, and to stop them deceased inserted a sprag in one of the wheels, and was attempting to put a prop into another wheel. He did not insert the prop sufficiently far and it swung round and threw him under the moving waggons.

No. 49, Appendix A.—Deceased was crushed between the buffers of an empty and loaded waggon, which along with others were being moved on the colliery sidings by a locomotive engine. He had uncoupled the two waggons between which he was crushed, and had given a signal by waving his arm, which was understood to mean "back slowly," he then attempted to pass between the waggons, which were slightly apart, and was caught while doing so. It appeared to me that there had been some misunderstanding of the signal given, and that deceased had not expected the waggons to collide. Deceased was employed by the North British Railway Company, on whose system the colliery is situated, and who not only led the coal but worked the traffic about the screens and on the colliery sidings by a staff specially appointed for that purpose, acting, in fact, as contractors for doing work which otherwise would have been performed by the colliery owners. The case is therefore included in Appendix A.

No. 59, Appendix A.—This accident took place at the end of a siding at the junction of the owner's branch railway with the main line, at a distance of about two miles from the pit. Deceased and some other labourers were sent to do some work near the junction, and had ridden down on the top of some waggons loaded with oil shale. As the waggons were being shunted back into the siding the men proceeded to get down, but the guard warned them to remain seated until the waggons had stopped. Deceased, who was on the second waggon, however, got over its front end and stood upon the buffer. The leading wheels of the front waggon dropped over the ends of the rails, the rear buffers were tilted up and overrode that on which deceased stood, severely crushing his right leg below the knee. He died on same day from shock and loss of blood.

No. 60, Appendix A.—This was the only fatal accident to a woman about the mines in the district, and was caused by deceased, who was a pithead worker, attempting to remove a piece of coal from the bottom deck of a double-decked cage, after a signal had been given to

the engineman to place the top deck level with the pithead. She was crushed between the cage and plates.

PART V.

FATAL ACCIDENTS AND DEATHS not comprised at MINES under the COAL MINES REGULATION ACT.

In addition to the fatal accidents in and about the mines, and on private branch railways, &c. to the persons employed (Appendix A.) there were eight other fatalities reported, and which are described in Appendix B., but which are not classed as accidents under the Coal Mines Act. This list comprises a fatal accident to a tramp by falling down a shaft; two fatal accidents on the surface at mines to persons ordinarily employed, but who were not at work at the time; two deaths in or about the mines from natural causes of persons employed; two cases of suicide and the death of a sinker from lung disease following a slight accident received while at work and from which he had apparently recovered.

It is sometimes difficult to decide whether a death should be classed as a mining accident or as resulting from natural causes; a slight accident to a person in a bad state of health may hasten death, although an ordinarily healthy person would soon have recovered from the injury.

PART VI.

NON-FATAL ACCIDENTS at MINES under the COAL MINES REGULATION ACT.

Three hundred and forty-one non-fatal accidents, causing injury to 352 persons, were reported, and are described in Appendix C.

Tables VIII. and IX. give additional particulars respecting the non-fatal explosions of fire-damp (including the fatal case), and of explosives.

Thirty-five explosions of fire-damp were reported, causing the death of one person and injury to 36 persons. They were all small ignitions, and were in no case complicated by coal dust. Twenty of the explosions occurred in Oil Shale Mines, and of this number 13 occurred at the Pentland Oil Shale Mine. No fewer than seven officials, including six firemen and one roadsman, ignited fire-damp.

In both the cases, Nos. 20 and 24 in the Table, the fireman stated that when making his inspection with a safety lamp, before the entry of the workmen, he lost his light and struck a match to relight it, when an explosion occurred; the mines were worked with naked lights, but as gas had been seen within the preceding 12 months, the fireman's inspection required to be made with a locked safety lamp. In a mine where safety lamps are used by the miners it would have been illegal to carry matches, but it is not quite clear that this would apply to a fireman making an inspection with a safety lamp of a mine where safety lamps were not used by the miners. I have a strong suspicion in these cases that the firemen were using an open light, and to screen themselves stated that the striking of a match caused the explosion.

The cause of ignition in No. 29 explosion was the flame of a gunpowder shot fired by a fireman in the coal in a stooping place, in the Ell coal seam, which is worked with safety lamps; the person who was burned was several yards away from the shot; as a quantity of timber was interposed between him and it, and as the shot was not blown out, it appeared that gas lying in the waste had been ignited and the flame reached the injured person. The fireman stated he examined the place carefully before lighting the shot, and found no gas, but when I examined it shortly after the accident, I found a distinct cap on the flame of the safety lamp within a yard or two of the place where the shot was fired. The place was dry and somewhat dusty. The practice of firing shots in the stooping where the depth is sufficient, as it was in this case, to make it probable that gas will collect in the waste, is a dangerous one, and the manager agreed to discontinue it.

The remaining explosions of fire-damp were all caused by ordinary open lights.

25 explosions of explosives, causing injuries to 29 persons, were reported, and are described in Table IX.

LIST OF EXPLOSIONS OF FIRE-DAMP.

TABLE VIII.

Number.	Date.		Hour.	Mine.	Seam.	Occupation of Persons killed or injured.	Class of Working.	Barometer.		Persons injured.	Persons killed.
								Height at Glasgow* Observatory.	R. Rising. F. Falling.		
1	Jan.	7	6 30 AM	Pentland	Broxburn Oil Shale	Miner	Close place	[illegible]	R.	1	—
2	„	16	6 15 AM	„	„	Miners	„	[illegible]	F.	2	—
3	„	16	10 30 PM	Home Farm	Splint Coal	Miner	„	29·891	R.	1	—
4	„	21	11 30 AM	Addiewell	Addiewell Oil Shale	„	„	30·166	R.	1	—
5	„	26	7 0 AM	„	Broxburn Oil Shale	Fireman, Drawer	Long-wall	[illegible]	R.	2	—
6	„	28	5 30 AM	Broxburn	„ „ „	Miner	Close place	[illegible]	F.	1	—
7	Feb.	3	3 30 AM	Pentland	„ „ „	Drawer	„	[illegible]	R.	1	—
8	„	22	7 30 AM	Greenhill	Upper Drumgray Coal	Miner	Long-wall	29·114	R.	1	—
9	Mar.	12	10 30 PM	Pentland	Fells Oil Shale	Drawer	Close place	29·282	R.	1	—
10	„	14	1 0 AM	„	Broxburn Oil Shale	Fireman	„	29·462	F.	1	—
11	„	29	7 45 PM	„	„ „ „	Drawer	„	29·740	F.	1	—
12	April	6	1 30 PM	Fence	Lesmahagow Gas Coal	Miner	Long-wall	29·966	F.	1	—
13	„	10	1 30 AM	Polbeth	Broxburn Oil Shale	Fireman	Close place	30·151	F.	1	—
14	„	15	11 30 AM	Pentland	Dunnet Oil Shale	Miner	„	29·826	F.	1	—
15	„	15	1 0 PM	Rawyards	Virtuewell Coal	„	Long-wall	29·822	F.	1	—
16	May	1	1 30 PM	Motherwell	Splint Coal	Roadsman	Stooping	29·728	F.	1	—
17	„	22	8 0 AM	Pentland	Fells Oil Shale	Miner	Long-wall	29·631	R.	1	—
18	„	29	10 0 AM	Gartness	Lower Drumgray Coal	„	„	29·965	R.	1	—
19	„	29	12 0 Mid.	Darngavil	Upper Drumgray Coal	Drawer	„	29·994	F.	1	—
20	„	31	6 0 AM	Philpstoun	Broxburn Oil Shale	Fireman	Close place	29·881	R.	1	—
21	June	2	6 0 PM	Pentland	„ „ „	Drawer	„	29·617	R.	1	—
22	„	13	9 4 PM	Balquhatstone	[illegible] Coal	Miner	Long-wall	[illegible]	R.	1	—
23	July	11	2 0 AM	Pentland	Fells Oil Shale	„	„	29·567	F.	1	—
24	„	31	8 0 AM	„	Main Oil Shale	Fireman	Close place	29·698	R.	1	—
25	Sep.	2	6 30 AM	Kinneil	Six Feet Coal	„	Long-wall	29·885	R.	1	—
26	„	7	6 30 AM	Pentland	Main Oil Shale	Miner	Close place	29·814	R.	1	—
27	„	18	7 0 AM	Monkland	Upper Drumgray Coal	„	Long-wall	29·265	F.	1	—
28	„	20	8 15 AM	Cornsilloch	Splint Coal	„	Close place	29·101	R.	1	—
29	Oct.	12	1 30 PM	Fairhill	Ell Coal	„	Stooping	29·705	R.	1	—
30	„	13	9 45 AM	Pentland	Main Oil Shale		Close place	29·841	F.	1	—
31	„	23	11 30 PM	Quarter	Splint Coal	„	„	30·027	F.	1	—
32	„	24	6 30 PM	Hopetoun	Broxburn Oil Shale	„	„	29·741	F.	1	—
33	Nov.	13	6 0 AM	Cowdenbeath	Five Feet Coal	„	Long-wall	30·049	F.	—	1
34	„	26	6 15 AM	Philpstoun	Broxburn Oil Shale	Fireman	Upset	30·171	R.	1	—
35	Dec.	5	10 30 PM	Newbattle	Strata above Parrot Coal	Sinker	Blind pit	29·730	F.	1	—
										36	1

* Add ·205 to reduce to mean sea level.

LIST OF EXPLOSIONS OF GUNPOWDER, &c.

TABLE IX.

No.	Mine.	Explosives used.	Persons killed.	Persons injured.	Cause of Accident.
1	Addiewell	Gunpowder	—	1	Miner in act of lighting fuse ignited fire-damp, he hurried from place, another miner approached to examine place, when shot exploded.
2	Broxburn	„	—	1	While trimming lamp, spark fell from it, and ignited gunpowder scattered from shot.

No.	Mine.	Explosives used.	Persons killed.	Persons injured.	Cause of Accident.
3	Fallahill - - -	Gelatine - -	—	1	Returned too soon to shot he thought had missed fire.
4	Redford - - -	Gunpowder -	—	2	Placed gunpowder flask on lodge fire, thinking it was tea flask.
5	Knownoble - -	„ -	—	1	Spark from lamp in cap fell into gunpowder canister.
6	Coltness - - -	„ -	—	1	Spark from lamp in cap fell into cartridge box.
7	Mainbank - - -	„ -	—	1	Shot exploded while igniting damp fuse.
8	Merryton - -	„ -	—	3	Ignited red fuse in bottom shot in stone; shot hung fire 32 minutes and exploded on them.
9	Addiewell - - -	„ -	—	1	Struck by stone from shot.
10	Dalbeath - - -	„ -	—	1	Ignited squib instead of slow match.
11	Clydesdale - - -	„ -	—	1	Spark from lamp in cap fell on gunpowder.
12	Blackridge - -	Gelatine - -	—	1	Ignited fuse of two shots. Thought one had missed fire, but on returning to place it exploded.
13	Dewshill - - -	Gunpowder -	—	1	Spark from lamp, or lamp itself, fell on to gunpowder.
14	Shawfield - -	„ -	—	1	While making squib in mine, spark from lamp in cap fell on gunpowder.
15	Philpstoun - - -	„ -	—	1	Ignited squib of shot instead of slow match.
16	Dalbeath - - -	Gelatine - -	—	1	Approached unawares to a shot.
17	Riddochhill - -	Gunpowder -	—	1	Spark from lamp in cap fell on to cartridge he was carrying.
18	Bent - -	„ -	—	1	Compressed gunpowder exploded while pushing it into hole in faikes with composition stemmer. Safety lamps in use.
19	Shieldhill - -	„ -	—	1	Shot exploded before he got clear; too short a straw and paper match.
20	Cam'nethan - -	„ -	—	2	Spark from lamp fell on loose gunpowder while making squib.
21	Loanhead - -	„ -	—	1	Two shots ready to fire. Ignited fuse of both, and before clear one exploded.
22	Pumpherston - -	„ -	—	1	Gunpowder fell from cartridge in hole on to lamp in cap.
23	Dunnikier - -	Gelatine dynamite -	—	1	Approached unawares to a shot.
24	Bankend - - -	Gunpowder -	—	1	Returned too soon to a shot he thought had missed fire.
25	Addiewell - -	Detonator - -	—	1	Found rejected detonating cap, and while picking it with pin, it exploded.
		Total -	—	29	

PART VII.

PROSECUTIONS UNDER THE COAL MINES REGULATION ACT.

Table X. is a list of prosecutions under the Coal Mines Regulation Act, and Special Rules founded thereon, in the district during the past year.

Table X.

No.	Date of Trial.	Name and Occupation of Person charged.	Place where, and date when offence charged with was committed.	Nature of Charge.	Result of Trial.
	1893.				
1	January 9	Hugh Henry, fireman	No. 8, Straiton Oil Shale Mine; 7th January 1893.	General Rule 4 (i). Special Rules 35 and 37.	Fined 1*l.* or 30 days.
2	January 13	John Grant, manager	Home Farm Colliery:— (1) Between 1st November and 21st December 1892. (2) " "	(1) Contravening General Rule 24. Failure to appoint engineman over 22 years. (2) Contravening General Rule 30. Failure to have brake to drum of engine.	Accused pled guilty and was fined 2*l.* 10*s.* for each offence or 14 days' imprisonment.
3	January 16	Duncan Marr Mowat, manager.	Dunsyston Colliery; 5th December 1892.	Contravening General Rule 4.	Fined 5*l.* Pled guilty.
4	January 24	Robert Dawson, fireman	Straiton Oil Shale Mine; 17th January 1893.	General Rule 4 (i). Special Rules 37 and 38.	Fined 3*l.* or 14 days.
5	January 25	John Gilhooly, miner Thomas Gilhooly, miner	No. 2, Pentland Oil Shale Mine; 19th December 1892.	General Rule 4 (i). Special Rule 67.	Not proven. "
6	January 27	Peter Dale, reddsman	Udston Colliery, Hamilton; 19th January 1893.	Contravening General Rule 10 (iv). In possession of five matches where safety lamps used.	Accused pled guilty and was fined 10*s.* or 7 days.
7	February 17	William Frew, oversman	Barncluith Colliery; 10th January 1893.	Contravening Special Rule 7. Failure to enforce Special Rule 72, as to men riding on hutches.	Accused pled not guilty, and the charge was found not proved
8	February 22	John Robertson, roadsman	Nos. 4 and 9, Straiton Oil Shale Mines; between 1st and 10th February 1893.	General Rule 5. Special Rule 48.	Fined 30*s.* or 14 days.
9	March 14	John Clark, pony driver	Udston Colliery; 22nd February 1893.	Contravening Special Rule 98. Failure to shut trap door.	Accused was tried and convicted and fined 10*s.* or 7 days.
10	March 17	Duncan Murray, fireman	No. 5, West Longrigg; 27th February 1893.	Contravening General Rule 4 (ii). Special Rule 40.	Fined 20*s.* or 14 days. Pled guilty.
11	March 20	James Paul, manager	Ramsay Pit; between 1st January and 14th February 1893.	General Rule 4 and section 50.	Fined 5*l.*
12	April 5	John Drain, fireman	No. 8, Straiton Oil Shale Mine; 20th March 1893.	General Rule 4, and Special Rule 35.	Fined 2*l.* or 14 days.
13	April 12	James Campbell, fireman. Thomas Grant, fireman	Lingerwood Pits, Newbattle; 9th March 1893.	Special Rule 24 (14).	Fined 10*s.* or 5 days. " "
14	April 14	Thomas Whitelaw, drawer	No. 13, Pit Niddrie; 14th March 1893.	Sup. Special Rules G. and I.	1*l.*, caution, F.O. Act.
15	"	George Sneddon, drawer	" "	Sup. Special Rule G.	" "
16	April 17	Charles Hunter, miner	No. 5, Pit of Carronhall Colliery, Carron, Stirlingshire; 27th March 1893.	Proceeding to his working place before it had been examined and reported to be safe, contrary to the Coal Mines Regulation Act, 1887, Section 49, General Rule 4 (i).	5*s.* of penalty or 3 days' imprisonment.
17	"	Cornelius Hunter, miner	No. 5, Pit of Carronhall Colliery, Carron, Stirlingshire; 1st April 1893.	" "	" "
18	April 21	Archibald Cook, miner	Eddlewood Colliery, Hamilton; 28th March 1893.	Contravening Special Rule 90. Placing lamp within swing of pick.	Accused pled guilty and was fined 15*s.* or 10 days.
19	April 24	William McNeil, miner	No. 13, Pit Niddrie; 27th March 1893.	General Rule 22, and Special Rule 73.	Fined 10*s.* or 3 days.
20	April 25	William Dunse, drawer	No. 8, Straiton Oil Shale Mine; 29th March 1893.	General Rule 4, and Special Rule 67.	" "
21	May 3	Andrew Beattie, fireman	No. 27, Polbeth Oil Shale Mine; between 1st and 8th April 1893.	General Rule 4 (i).	1*l.*, caution, F.O. Act.
22	July 17	Michael Mulvey, miner	No. 1, West Craigs; 3rd July 1893.	Contravening General Rule 12.	Fined 20*s.* or 14 days. Pled guilty.
23	August 1	James Johnstone, miner	Eddlewood Colliery; 27th July 1893.	Contravening Special Rule 90. Placing lamp within swing of pick.	Accused pled guilty and was fined 20*s.* or 14 days.
24	August 11	James Mott, miner	Barncluith Colliery; 1st August 1893.	Contravening General Rule 10 (iv). In possession of two matches.	Pled guilty. 10*s.* or 7 days.
25	August 15	James Monaghan, miner	Eddlewood Colliery; 24th July 1893.	Contravening Special Rule 90. Placing lamp within swing of pick.	Accused pled guilty and was fined 20*s.* or 14 days.

No.	Date of Trial.	Name and Occupation of Person charged.	Place where, and date when offence charged with was committed.	Nature of Charge.	Result of Trial.
26	September 16 - -	Alexander Seath, colliery manager.	Denend Coal Pit, parish of Auchterderran; 15th August 1893.	Contravening of Special Rules 6 and 7.	Pled guilty and sentenced 30*s*. or 3 days.
27	" - -	Thomas Hill, pit inspector	" " -	Contravening of General Rule 4 (ii).	Pled guilty. 5*s*. or 1 day.
28	October 11 - -	John Haggerty, miner -	No. 4, Oil Shale Mine, Straiton; 7th September 1893.	General Rule 4 (i) and Special Rule 67.	Found not proven.
29	November 28 - -	James Borland, miner -	Earnock Colliery; 9th November 1893.	Contravening Special Rule 87 (6). In possession of pipe for smoking.	Pled guilty. 20*s*. or 14 days.
30	" - -	James O'Neil, miner -	" " -	" " -	" "
31	December 19 - -	John Grant, owner and manager.	Fairholm Colliery; 10th November 1893.	Contravening Section 16. Employing 22 persons in pit with only one outlet.	Pled guilty. 4*l*. or 30 days.
32	" - -	James Dawson, pit inspector.	No. 7, Pit of the Cowdenbeath Coal Company, Limited, parish of Beath; 13th November 1893.	Contravening of Special Rule 38.	Pled guilty and sentenced 2*l*. or 14 days on agreeing to subscribe 3*l*. to Edinburgh Royal Infirmary.

PART VIII.

COMPLAINTS from MINES under the COAL MINES REGULATION ACT.

I give a list of complaints and intimations of danger received in writing during the year. All were promptly attended to. It will be observed that questions connected with the weighing clauses of the Act are a fruitful source of complaint, and I foresee considerable trouble in the future in connexion therewith.

11 January.—Anonymous complaint as to the condition of an oil shale mine.
13 January.—Complaint from the checkweigher at a colliery as to the tare of the hutches.
17 January.—Complaint from the checkweigher at a colliery as to want of facilities.
25 January.—Complaint from the checkweigher at a colliery as to the tare of the hutches.
30 January.—Anonymous complaint as to danger from fire-damp at a colliery.
7 February.—Anonymous complaint as to employing enginemen under age at a colliery.
7 February.—Complaint as to removing a boiler fireman from a colliery.
8 February.—Complaint as to the state of the ventilation in two collieries, and as to the usage of the horses in a third colliery.
3 April.—Anonymous complaint from a colliery as to the want of timber and inefficient management.
5 April.—Complaint as to the removal of a boiler fireman on Sabbath days at a colliery.
10 April.—Complaint from the checkweigher at a colliery as to the means adopted to secure his dismissal.
10 April.—Complaint as to the state of the shafts at a colliery.
10 April.—Complaint as to the tare of the hutches at a colliery.
21 April.—Anonymous complaint as to the inspection by the officials and ventilation of several collieries.
26 April.—Complaint from a colliery as to the inspection by the officials, want of shuts and absence of special rules.
5 May.—Anonymous complaint as to an unfenced shaft and incompetent fireman at a colliery.
27 May.—Anonymous complaint as to above.
8 May.—Complaint as to danger from water in a reservoir above the workings of a colliery.
8 May.—Anonymous complaint from a colliery as to inadequate supervision by the manager.
16 May.—Complaint as to the ventilation of a colliery.
19 May. " " "
29 May. " " "
1 June.—Complaint as to the want of manholes on the haulage roads in a colliery.
8 June.—Complaint as to the checkweigher being refused the tare of the hutches at a colliery.
9 June.—Complaint as to the tare of the hutches at a colliery.
15 June.—Complaint as to the ventilation of a colliery.

19 June.—Anonymous complaint as to the ventilation of a colliery, and employment of too young a man to look after the boilers at another colliery.
20 June.—Complaint as to the ventilation of a colliery.
5 July.—Complaint as to the refusal of the pithead-man at a colliery to allow the checkweigher to have the tare of the hutches.
22 July.—Anonymous complaint as to the ventilation of a colliery.
24 July.—Complaint as to danger from water in old workings at a colliery.
11 August.—Complaint as to smoke caused by blasting at a colliery. Also violation of Special Rule 35.
26 August.—Complaint as to an incompetent engineman at a colliery, and as to the method of weighing the hutches at another colliery.
29 August.—Complaint from the checkweigher at a colliery as to the hutches not being truly weighed.
15 September.—Complaint as to the employment of unskilled workmen at a colliery.
15 September.—Complaint as to the state of the winding gear at a colliery.
19 September.—Two anonymous complaints as to ventilation of a colliery.
21 September.—Complaint from the checkweighers at an oil shale mine as to mode of ascertaining deductions.
23 September.—Complaint as to danger from the sump at a colliery.
19 September.—Complaint as to the tare of the hutches at a colliery.
1 November.—Complaint as to the manager refusing to allow the checkweigher to perform his duties at a colliery.
3 November.—Anonymous complaint as to there being no certificated manager at a colliery.
8 November.—Complaint as to the manager refusing to allow the checkweigher to perform his duties at a colliery.
11 November.—Complaint as to the ventilation of a colliery.
20 November.—Complaint of the checkweigher at a colliery that he is frustrated in the performance of his duties.
23 November.—Anonymous complaint as to the want of manholes on the haulage road in a colliery.
25 November.—Complaint as to the ventilation of two collieries.
11 December.—Complaint that the checkweigher is not allowed by the manager to perform his duty at a colliery.
15 December.—Complaint that the miners go to their working places at a colliery before the fireman has made his inspection; and as to ventilation at another colliery.
29 December.—Complaint as to an unfenced entrance to the shaft at a colliery.

Part IX.

Board for Examinations for Managers' Certificates.

The Board for Examinations for Granting Certificates of Competency to Managers and Undermanagers of Mines is constituted as follows:—

William Laird, Esq., John Austine, Esq., James Mungall, Esq.,	Owners' Representatives.
Alex. Simpson, Esq., J. W. Ormiston, Esq, Henry Telfer, Esq.	Mining Engineers.
Mr. John Simpson, Mr. Thos. Sandridge, Mr. Hector McNeil,	Workmen's Representatives.

J. B. Atkinson, H.M. Inspector of Mines (Chairman).

R. Calder, B.Sc., M.A. (Secretary).

The Examiners are: Jonathan Hyslop, M.E., the Secretary, and James Ormiston, M.E. The latter gentleman was appointed at the last meeting of the Board in succession to the late Lawrence Hill, C.E.

At the annual examination held in Edinburgh, on the 18th and 19th May last, 53 candidates were examined for managers' certificates and 32 passed; for undermanagers' certificates, there were 47 candidates examined, and 44 passed.

PART X.

MINES UNDER THE METALLIFEROUS MINES ACT.

Table XI. gives a summary of the information contained in the annual returns for the past year as to persons employed and mineral raised at mines in the district under the Metalliferous Mines Regulation Act, 1872. The table is arranged in the same order as that for the mines under the Coal Mines Act.

TABLE XI.

Counties.	Underground. Male Persons.			Aboveground. 10 to 13.		13 to 18.		Above 18.			Total Underground and Aboveground.	Tons of Mineral raised.		
	12 to 16.	Above 16.	Total.	Males.	Females.	Males.	Females.	Females.	Males.	Total.		Lime-stone.	Lead Ore.	Total.
Clackmannan	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Edinburgh	6	157	163	—	—	6	—	—	43	49	212	148,631	—	148,631
Fife	2	95	97	—	—	5	—	—	37	42	139	56,102	—	56,102
Haddington	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Lanark, Eastern portion	—	161	161	3	—	28	—	1	102	134	295	21,552	1,642	23,194
Linlithgow	—	4	4	—	—	—	—	—	6	6	10	2,787	—	2,787
Kinross, Peebles, and Sutherland	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Stirling, Eastern portion	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Totals 1893	8	417	425	3	—	39	—	1	188	231	656	229,072	1,642	230,714
" 1892	15	485	500	11	—	46	—	1	209	267	767	277,598	2,022	279,620
" 1891	20	455	475	6	—	52	—	1	199	258	733	196,629	2,084	198,713

The number of persons employed at, and the production of mineral from, mines under the Metalliferous Mines Rugulation Act during the past year does not differ materially from similar figures for the years 1891–2.

There was, however, only one fatal accident as compared with four in 1892 and three in 1891. This accident is given in Appendix D, and three non-fatal accidents in Appendix E. The fatal accident occurred at the face of a room in a limestone seam 4 feet 6 inches thick, with a holing of 7 inches of blaes and 2 inches of coal. Deceased was holing, and his partner, who stood near with his hand on the block which fell, felt it coming. He sprang back and shouted to deceased, who, however, could not get clear, but was instantly crushed to death, the block weighing four tons.

Every year there is a small quantity of gold obtained from alluvial workings in the valleys in the neighbourhood of Leadhills, in Lanarkshire. Old miners, after giving up regular work in the Leadhills lead mines, spend part of their leisure in this way. The total quantity of gold annually produced will not exceed a few ounces, but when gold is required for a special object it is sometimes obtained in considerable quantity. Although the labour as at present expended does not indicate that the industry could be a paying one, still it is possible that hydraulic mining on an extensive scale might give satisfactory results.

PART XI.

GENERAL REMARKS.

The profit attending mining operations in the district during the past year has been satisfactory in the case of coal only, which, with oil shale, fireclay, and ironstone, constitutes the great bulk of the mineral production. The latter three minerals, unlike coal, are not sold in the raw state to any great extent, but are mined and treated by oil companies, fire-brick makers, and ironmasters, and the profit is reckoned on the finished product.

The coal trade was inclined to be languid in the earlier part of the year, and fell into a very depressed state from February to the middle of July, during which time many contracts were

made at low prices, but during the miner's strike in the Midlands prices rose rapidly, and as there were only two strikes of any magnitude during the year, those already referred to on page 6 of this Report, the results on the whole have been satisfactory to owners, and the miners also obtained substantial advances in wages. The low price of coal, which ruled for the first half of the year, was favourable to oil companies, fire-brick makers, and ironmasters, but the enhanced prices afterwards paid counterbalanced this gain, and the strike near the end of the year cut off supplies of coal to such an extent that the partial stoppage of some of the oil works and blast furnaces became necessary. One of the products of the oil works and blast furnaces, sulphate of ammonia, advanced in price during the year, but oil and pig-iron were very low in price during the whole year.

The work of the district has been performed in the usual manner by myself and Mr. R. McLaren and Mr. H. Johnstone, the inspectors assisting. The scene of each fatal accident was inspected, and full inquiry made into it, and a report prepared and transmitted to the Lord Advocate, through the Procurator Fiscal of the district in which the accident happened. Inquiry was also made into all the non-fatal accidents reported, and in nearly every instance the scene of the accident was inspected. The investigation of the complaints referred to in Part VIII. took up a considerable portion of our time. Plans of abandoned mines, forwarded from the Home Office, were carefully compared with the originals, and in some cases the owners were asked to amend the plans or particulars, so as to comply with the requirements of the Act on this head.

Several applications for exemption from two shafts or outlets and from the use of gunpowder in cartridges were reported on.

Many inspections of a general nature were made without reference to accidents or complaints, and when inquiring into any special matter a section of a mine was usually examined.

I append the lists of accidents and list of mines in the district.

I have, &c.,
J. B. ATKINSON.

The Right Honourable H. H. Asquith, Q.C., M.P.,
Her Majesty's Principal Secretary of State,
Home Department, Whitehall, London.

APPENDIX A.

COAL MINES REGULATION ACT.

LIST of the FATAL ACCIDENTS, and DEATHS arising therefrom within one Year and a Day from the Date of the Accident, in and about the Mines in the District, including those on Private Branch Railways and Tramways, and in Washing and Coking Coal, during the Year 1893.

No. of Accidents.	Date and Hour of the Accident.	Hour of the Person's Shift, i.e., No. of Hours he had been at Work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate. (County.)	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Fire-damp.	Lives lost. Falls of Roof and Sides.	Lives lost. In Shafts.	Lives lost. Miscellaneous Underground.	Lives lost. Above Ground.	Lives lost. Total.
	1893.														
1	Jan. 10 3.30 p.m.	1st	Barncluith	Lanark	Archibald Russell	Patrick Clark John Wilson	24 28	Miner "	Fall of roof on engine plane	–	2	–	–	–	2
2	Jan. 14 7.30 a.m.	1st	Ross	"	Coltness Iron Co. (Lim.)	James Kirkhope	18	Labourer	Crushed by cage	–	–	1	–	–	1
3	Jan. 19 10.30 a.m.	3rd	Bonnyside	Stirling	James Dougall and Sons (Lim.)	Robert Marshall	52	Miner	Fall of stone	–	1	–	–	–	1
4	Jan. 20 5.15 p.m.	4th	Newbattle	Edinburgh	Lothian Coal Co. (Lim.)	John Neesam	41	Sinker chargeman.	Knocked off kettle	–	–	1	–	–	1
5	Jan. 27 7.30 a.m.	2nd	Lochgelly	Fife	Lochgelly Iron and Coal Co. (Lim.).	Henry Gillis	41	Miner	Fall of stone	–	1	–	–	–	1
6	Feb. 7 7 p.m.	5th	Newbattle	Edinburgh	Lothian Coal Co. (Lim.)	Charles Pryde	17	Dook footer	Crushed by tub	–	–	–	1	–	1
7	Feb. 13 12.5 a.m.	2nd	Loanhead	"	Shotts Iron Co.	Thomas Drylie Andrew Hislop	33 21	Miner "	Fall of stone from roof and pavement.	–	2	–	–	–	2
8	Feb. 23 3 a.m.	5th	Kelty	Fife	Fife Coal Co. (Lim.)	John Syme	42	Brusher	Fall of stone	–	1	–	–	–	1
9	Feb. 23 10.30 a.m.	5th	Dundonald	"	Dundonald Coal Co.	William Campbell	42	Miner	Fall of blaes	–	1	–	–	–	1
10	Mar. 1 1.30 p.m.	7th	Leven	"	Fife Coal Co. (Lim.)	Joseph Cumming	36	"	Fall of coal	–	1	–	–	–	1
11	Mar. 2 11.15 a.m.	5th	Ross	Lanark	Thomas Barr	Charles Reid	24	Screenman	Run over by waggon	–	–	–	–	1	1

List of the Fatal Accidents—*continued.*

No. of Accidents.	Date and Hour of the Accident.	Hour of the Person's Shift, i.e., No. of Hours he had been at Work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate. (County.)	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.	Total.
12	Mar. 8 1.45 p.m.	7th	Dewshill	Lanark	Coltness Iron Co. (Lim.)	Alexander Baxter	19	Boiler fireman.	Fell down pit	–	–	1	–	–	1
13	Mar. 24 1.45 p.m.	7th	"	"	"	Jacob Armour	25	Miner	Fall of stone	–	1	–	–	–	1
14	Mar. 25 2.30 p.m	8th	Clyde	Lanark	Wilson's and Clyde Coal Co. (Lim.)	Peter McNaughton	60	Waggon runner.	Run over by waggon	–	–	–	–	1	1
15	Mar. 27 10.15a.m.	5th	Carronhall	Stirling	Carron Co.	Alexander Hunter	64	Miner	Fall of coal	–	1	–	–	–	1
16	Apr. 6 3.15 p.m.	9th	Quarter	Lanark	Colin Dunlop & Co.	John McGregor	27	Driver	Fall of roof	–	1	–	–	–	1
17	Apr. 7 8.0 a.m.	2nd	Newbattle	Edinburgh	Lothian Coal Co. (Lim.)	James Lynch	44	Boiler cleaner	Suffocated by steam	–	–	–	–	1	1
18	Apr 8 6.15 a.m.	1st	Kingseat	Fife	Wallace Bros.	Abram Moffat	59	Roadsman	Crushed by hutches	–	–	–	1	–	1
19	Apr. 13 9.0 p.m.	3rd	Pentland	Edinburgh	Clippens Oil Co. (Lim.)	Matthew Judge	26	Drawer	Jammed by hutch	–	–	–	1	–	1
20	Apr. 24 9.30 a.m.	3rd	Clyde	Lanark	Wilson's and Clyde Coal Co. (Lim.)	David Smith	46	Miner	Crushed by hutches on haulage road.	–	–	–	1	–	1
21	Apr. 24 10.10p.m.	1st	Coltness	"	Coltness Iron Co. (Lim.)	Thomas Martin	38	Drawer and pony-driver	Crushed by horse	–	–	–	1	–	1
22	May 5 3.30 p.m.	9th	Allanton	"	Morningside Coal Co.	Andrew Kyle	32	Miner	Fall of stone	–	1	–	–	–	1
23	May 16 4.0 p.m.	3rd	Lochgelly	Fife	Lochgelly Iron and Coal Co. (Lim.).	William Fleming	38	Roadsman	Stone fell down brae	–	–	–	1	–	1
24	May 18 9.30 p.m.	1st	Cardenden	"	Rattray, C. C. M.	James Skinners	57	Sinker	Kettle fell down pit	–	–	1	–	–	1
25	May 23 12.30p.m.	11th	Dysart	"	Rosslyn, Earl of	Alexander Barclay	48	Pit bottomer	Coal fell down pit	–	–	1	–	–	1
26	May 28 5.0 a.m.	7th	Newbattle	Edinburgh	Lothian Coal Co. (Lim.)	Alexander Gordon	36	Sinker	Rider fell upon him	–	–	1	–	–	1
27	June 6 12 noon	7th	Pumpherston	"	Pumpherston Oil Co.(Lim.)	John Nailen	40	Roadsman	Crushed by carriage	–	–	–	1	–	1
28	June 8 3.20 p.m.	9th	Muiredge	Fife	Bowman & Co.	Alexander Deas	12	Hanger-on	Crushed by cage	–	–	1	–	–	1

List of the Fatal Accidents—*continued.*

No. of Accidents.	Date and Hour of the Accident.	Hour of the Person's Shift, *i.e.*, No. of Hours he had been at Work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate. (County.)	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.	Total.
29	June 9 2.0 p.m.	8th	Newbattle -	Edinburgh -	Lothian Coal Co. (Lim.) -	John Inglis - -	17	Dook-footer	Bar fell down dook - -	–	–	–	1	–	1
30	June 12 1.0 p.m.	7th	Mosside - -	Linlithgow -	Gavin Paul and Sons -	George Rennie -	53	Miner -	Fall of coal - -	–	1	–	–	–	1
31	June 21 3.0 a.m.	9th	Pumpherston -	Edinburgh -	Pumpherston Oil Co. (Lim.)	Walter H. Currie -	19	" -	Fall of shale - - -	–	1	–	–	–	1
32	June 23 8.10 a.m.	2nd	Springbank -	Lanark - -	Springbank Colliery Co. (Lim.).	Alexander Ross -	21	Drawer -	Crushed by hutches -	–	–	–	1	–	1
33	July 6 11.30 p.m.	2nd	Brownlee -	" - -	Archibald Russell - -	Robert Smith -	23	Brusher -	Fall of stone - -	–	1	–	–	–	1
34	July 7 4.0 p.m.	9th	Shawsburn -	" - -	W. and D. Sym - -	William Sym -	17	Reddsman -	Fall of roof - -	–	1	–	–	–	1
35	July 11 7.0 a.m.	1st	Kelty - -	Fife - -	Fife Coal Co. (Lim.) -	Angus Stewart -	56	Labourer -	Run over by waggons -	–	–	–	–	1	1
36	July 14 12.15 p.m.	7th	Pentland -	Edinburgh -	Clippen's Oil Co. (Lim.) -	Alexander Kent -	30	Miner -	Fall of roof - -	–	1	–	–	–	1
37	July 31 11.0 a.m.	4th	Bent - -	Lanark - -	Bent Colliery Co. (Lim.) -	Thomas Burns -	59	" -	Fall of stone - -	–	1	–	–	–	1
38	Aug. 8 10.30 a.m.	4th	Donibristle -	Fife - -	Donibristle Colliery Co. -	Robert Pryde -	20	" -	Fall of coal - -	–	1	–	–	–	1
39	Aug. 21 6.30 p.m.	3rd	Clyde - -	Lanark - -	Wilson's and Clyde Coal Co. (Lim.)	John McDowall -	27	Roadsman -	Fall of stone - -	–	1	–	–	–	1
40	Sept. 12 7.15 a.m.	3rd	Alloa - -	Clackmannan -	Alloa Coal Co. - -	Thomas Adamson -	59	Viewer -	" - - -	–	1	–	–	–	1
41	Sept. 15 2.30 p.m.	8th	Carberry - -	Edinburgh -	Deans and Moore - -	James King - -	36	Miner -	Fall of head coal - -	–	1	–	–	–	1
42	Oct. 3 2.0 p.m.	8th	Polton -	" -	Lothian Coal Co. (Lim.) -	Charles Orman -	37	" -	Fall of roof - - -	–	1	–	–	–	1
43	Oct. 15 10.30 p.m.	1st	Kinneil - -	Linlithgow -	Kinneil Coal and Coke Co.	James Robertson -	20	Drawer -	Crushed by hutches -	–	–	–	1	–	1
44	Oct. 16 12 noon	6th	Allanton -	Lanark - -	Morningside Coal Co. -	Patrick Donahay -	60	Miner -	Fall of roof - -	–	1	–	–	–	1

List of the Fatal Accidents—*continued.*

No. of Accidents.	Date and Hour of the Accident.	Hour of the Person's Shift, i.e., No. of Hours he had been at Work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate. (County.)	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.	Total.
45	Oct. 16 11.30a.m.	6th	Elphingstone -	Haddington -	R. and J. Durie - -	Andrew Nelson -	43	Miner -	Fall of coal - -	–	1	–	–	–	1
46	Oct. 17 10.45a.m.	4th	Woodend -	Linlithgow -	Coltness Iron Co. (Lim.) -	Henry Black -	32	" -	" - - -	–	1	–	–	–	1
47	Oct. 21 2.40 p.m.	9th	Seafield - -	" -	Pumpherston Oil Co. (Lim.)	John Shaw - -	47	Roadsman -	Crushed by carriage -	–	–	–	1	–	1
48	Oct. 24 12.5 p.m.	7th	Cowdenbeath -	Fife - -	Cowdenbeath Coal Co. (Lim.).	William Macintyre	22	Loco-shunter	Run over by waggon -	–	–	–	–	1	1
49	Nov. 4 1.40 p.m.	9th	Gartness - -	Lanark - -	Gartness Coal Co. - -	Robert Colligan -	30	Railway guard.	Crushed by waggons -	–	–	–	–	1	1
50	Nov. 6 11.30a.m.	6th	Gilmerton -	Edinburgh -	Gilmerton Gas Coal Co. (Lim.)	Robert Crookston -	17	Drawer -	Fell down incline - -	–	–	–	1	–	1
51	Nov. 13 6.0 a.m.	1st	Cowdenbeath -	Fife - -	Cowdenbeath Coal Co. (Lim.)	William Swinton -	28	Miner -	Explosion of fire-damp -	1	–	–	–	–	1
52	Nov. 14 10.0 a.m.	4th	Rigg - -	Lanark - -	Ferrier and Strain - -	Thomas Jelly -	68	Bottomer -	Wandered into old road -	–	–	–	1	–	1
53	Nov. 17 1.0 a.m.	7th	Callendar -	Stirling -	Callendar Coal Co. -	James Gardner -	45	Miner and drawer.	Fall of coal - - -	–	1	–	–	–	1
54	Nov. 21 7.30 a.m.	2nd	Hill of Beath -	Fife - -	Fife Coal Co. (Lim.) -	John Nicol - -	35	Brusher -	Fall of stone - -	–	1	–	–	–	1
55	Nov. 27 9.30 a.m.	2nd	North Greengairs.	Lanark - -	Samuel Ritchie & Co. -	Robert Love -	44	Sinker -	Fell down pit - -	–	–	1	–	–	1
56	Dec. 6. 1.30 p.m.	8th	Niddrie -	Edinburgh -	Niddrie and Benhar Coal Co. (Lim.)	William King -	16	Drawer -	Fell down brake incline -	–	–	–	1	–	1
57	Dec. 8 11.0 p.m.	1st	Lathallan -	Fife - -	Thomas Brown and Sons	John Simpson -	50	Roadsman -	Fall of stone - -	–	1	–	–	–	1
58	Dec. 19 12.30p.m.	6th	Kelty - -	" - -	Fife Coal Co. (Lim.) -	John Penman -	23	Miner -	Fall of roof - -	–	1	–	–	–	1
59	Dec. 21 1.30 p.m.	7th	Ingliston -	Edinburgh -	Young's Paraffin Light and Mineral Oil Co. (Lim.).	Patrick Clarke -	50	Labourer -	Crushed by waggons - -	–	–	–	–	1	1
60	Dec. 30 1.0 p.m.	7th	Cowdenbeath -	Fife - -	Cowdenbeath Coal Co., (Lim.).	Mary Ann Hunter	18	Pithead-runner.	Caught by cage - -	–	–	–	–	1	1
										1	31	8	14	8	62

APPENDIX B.

List of Fatal Accidents and Deaths not comprised in and about the Mines in the District during the Year 1893.

No. of Accidents.	Date.	Name of the Mine or Colliery.	Where situate. (County.)	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.
1	Feb. 13	Benhar	Lanark	Robert Addie and Sons (Lim.)	Alexander Mack	41	Miner	Sudden death.
2	Feb. 17	Bankend	"	Bankend Coal Co. (Lim.)	John Donaldson	12	Jigger	By pump connecting rod. Not employed at the time. Pit idle.
3	May 7	Caldercruix	"	James Nimmo & Co. (Lim.)	-	—	Tramp	Fell down pit.
4	June 4	Rawyards	"	Rawyards Colliery Co. (Lim.)	Thomas Brown	56	Engineman	Natural death.
5	Oct. 6	Bellsdyke	"	Bellsdyke Coal Co.	Robert Paterson	49	Cashier	Jumped down pit. Suicide.
6	Oct. 15	Cowdenbeath	Fife	Cowdenbeath Coal Co. (Lim.)	Robert Dawson	32	Miner	" " "
7	Nov. 22	Dalbeath	"	Fife Coal Co. (Lim.)	David Fowler	15	Stone-picker	Tub fell from hoist. Not employed at the time.
8	Nov. 3	Newbattle	Edinburgh	Lothian Coal Co. (Lim.)	John Lowe	30	Sinker	Stone fell from side of shaft. Died 24 days afterwards from pneumonia.

APPENDIX C.

LIST of the NON-FATAL ACCIDENTS causing serious personal injury or arising from explosions of gas, or of any explosive, or of any Steam Boiler in the District, during the Year 1893.

No. of Accidents.	Date.	Name of the Mine or Colliery.	Where situate (County).	Name of the Owner or Company.	Persons injured.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Number of Days off Work, including Sundays and Holidays.	Persons seriously injured. Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.	Total.
1	June 7	Addiewell, Boghead	Linlithgow	Young's Paraffin Light and Mineral Oil Co. (Lim.).	Charles Brannen	35	Miner	Fall of roof	48	–	1	–	–	–	1
2	Jan. 21	" Polbeth & Limefield	Edinburgh	"	Alexr. Reid	30	"	Explosion of gas	85	1	–	–	–	–	1
3	" 26	" "	"	"	Wm. Crawford	29	Filler	" "	18	2	–	–	–	–	2
					Thos. McQueen	18	Drawer		18						
4	" 30	" "	"	"	Alexr. Robertson	30	Miner	Explosion of shot	20	–	–	–	1	–	1
5	Apr. 10	" "	"	"	Richd. Learmouth	54	Fireman	Explosion of gas	21	1	–	–	–	–	1
6	May 22	" "	"	"	John O'Neil	25	Miner	Struck by shale from shot	143	–	–	–	1	–	1
7	Nov. 17	" "	"	"	Smith Gilroy	17	Drawer	Fall over rail	*	–	–	–	1	–	1
8	Dec. 1	" "	"	"	Robt. Burns	26	Miner	Fall of roof	*	–	1	–	–	–	1
9	" 12	" "	"	"	Moses Sifton	45	Fireman	Fall down shoot	*	–	–	–	1	–	1
10	" 27	" "	"	"	William Main	15	Drawer	Explosion of dynamite detonator	*	–	–	–	1	–	1
11	Apr. 1	" Newliston	Linlithgow	"	John Johnstone	22	Pony driver.	Struck by bogie	111	–	–	–	1	–	1
12	Oct. 10	" "	"	"	Michael Grant	30	Miner	Bruised by hutches	17	–	–	–	1	–	1
13	Sept. 29	" Ingliston	Edinburgh	"	David Balloch	55	Sinker	Fell from kettle	*	–	–	1	–	–	1
14	Mar. 24	Allanshaw	Lanark	Allanshaw Coal Co.	Thos. Murphy	26	Pony driver.	Fall of head coal	18	–	1	–	–	–	1
15	Dec. 30	"	"	"	Wm. Thomson	45	Miner	Fall of coal	*	–	1	–	–	–	1

* Still off.

List of the Non-Fatal Accidents—*continued.*

No. of Accidents.	Date.	Name of the Mine or Colliery.	Where situate (County).	Name of the Owner or Company.	Persons injured.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Number of Days off Work, including Sundays and Holidays.	Persons seriously injured. Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.	Total.
16	Dec. 21	Allanton	Lanark	Wm. Barr and Sons	Patrick Irvine	25	Miner	Fall of coal	10	–	1	–	–	–	1
17	„ 5	Arniston	Edinburgh	Arniston Coal Co. (Lim.).	George Young	60	„	„	*	–	1	–	–	–	1
18	„ 25	„	„	„	John Smith	15	Pony driver.	Caught by trap-door	*	–	–	–	1	–	1
19	„ 28	„	„	„	Thomas Hare	33	Miner	Fall of stone	*	–	1	–	–	–	1
20	May 23	Armadale	Linlithgow	Armadale Coal Co.	John McInulty	18	Drawer	Fall of coal	‡	–	1	–	–	–	1
21	Oct. 25	Auchlochan	Lanark	W. C. S. Cunningham	Peter Smith	17	Miner	Fall of fire-clay	*	–	1	–	–	–	1
22	„ 12	Ashgill	„	Brand & Co.	Robt. Hawthorn	40	„	Fall of stone	61	–	1	–	–	–	1
23	„ 13	Auldton	„	„	James Brown	50	„	Finger bruised, putting hutch on rails	2	–	–	–	1	–	1
24	Mar. 27	Balbardie	Linlithgow	H. Walker and Cameron	John Vassie	17	„	Fall of side	24	–	1	–	–	–	1
25	Sept. 29	„	„	„	James Spalding	38	„	Fall of coal	28	–	1	–	–	–	1
26	Mar. 7	Balgonie	Fife	C. B. Balfour	Alexr. Dalrymple	19	Drawer	Finger crushed against end of hutch	22	–	–	–	1	–	1
27	May 13	„	„	„	Wm. Green	28	Miner	Fall of coal and stone	73	–	1	–	–	–	1
28	July 10	„	„	„	George Hutchison	56	„	Fall of coal	121	–	1	–	–	–	1
29	„ 29	„	„	„	George Wilson	18	Drawer	Fall of coal and stone	11	–	1	–	–	–	1
30	Aug. 17	„	„	„	David Hutchison	26	„	Fall of head-coal	132	–	1	–	–	–	1
31	Sept. 16	„	„	„	Thos. Reid	33	Miner	„ „	*	–	1	–	–	–	1
32	Dec. 2	„	„	„	Henry Patterson	45	Engineman	Crushed by pinion wheels	*	–	–	–	–	1	1

* Still off.
‡ Did not resume work at colliery.

List of the Non-Fatal Accidents—*continued.*

No. of Accidents.	Date.	Name of the Mine or Colliery.	Where situate (County).	Name of the Owner or Company.	Persons injured.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Number of Days off Work, including Sundays and Holidays.	Persons seriously injured. Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.	Total.
33	June 13	Balquhatstone	Stirling	John Nimmo and Son	John McNairn	23	Brusher	Explosion of gas	14	1	–	–	–	–	1
34	Dec. 20	Bankhead and Westown.	Lanark	Bankend Coal Co.	James Barry	30	Miner	Went back upon shot	10	–	–	–	1	–	1
35	July 27	Barblues	„	A. & G. Anderson	John Thomson	40	„	Fall of stone	21	–	1	–	–	–	1
36	Aug. 18	„	„	„	John Houston	13	„	Crushed by hutches	*	–	–	–	–	1	1
37	June 21	„ West Craigs	„	„	Robt. Mason	64	„	Finger crushed when lifting hutch on rails.	42	–	–	–	1	–	1
38	Mar. 2	Barncluith	„	Archd. Russell	Wm. Craig	19	„	Fall of coal	†	–	1	–	–	–	1
39	Aug. 2	Bathville	Linlithgow	James Wood (Lim.)	James Girvan	41	„	„	42	–	1	–	–	–	1
40	„ 26	„	„	„	John Bradley Henry Bradley	29 22	„ „	„	15 15	–	2	–	–	–	2
41	Apr. 26	Bellfield	Lanark	Wm. Barr and Sons	Robt. Mitchell	26	„	„	21	–	1	–	–	–	1
42	July 24	Bellsdyke	„	Bellsdyke Coal Co.	Wm. Carr	35	„	„	†	–	1	–	–	–	1
43	Aug. 19	„	„	„	Benjamin Carson	22	„	Fall of stone	†	–	1	–	–	–	1
44	„ 26	„	„	„	Wm. Walker	33	Trimmer	Run over by waggon	†	–	–	–	–	1	1
45	Feb. 7	Benarty	Fife	Lochore and Capledrae Cannel Coal Co. (Lim.).	James Cook	50	Screenman	Caught between waggon buffers	91	–	–	–	–	1	1
46	„ 27	„	„	„	John Morris	16	Bottomer	Struck by hutch	42	–	–	–	1	–	1

* Still off.
† No information.

List of the Non-Fatal Accidents—*continued.*

No. of Accidents.	Date.	Name of the Mine or Colliery.	Where situate (County).	Name of the Owner or Company.	Persons injured.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Number of Days off Work, including Sundays and Holidays.	Persons seriously injured. Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.	Total.
47	Feb. 9	Benhar	Lanark	Niddrie and Benhar Coal Co. (Lim.).	Robt. Shaw	30	Miner	Fall of roof	104	–	1	–	–	–	1
48	Oct. 14	„	„	R. Addie and Sons	Hugh McIlwraith	49	„	Fall of coal	*	–	1	–	–	–	1
49	May 9	Bent	„	Bent Colliery Co. (Lim.)	Henry Morrison	14	Dirt-picker.	Caught by machinery	42	–	–	–	–	1	1
50	„ 26	„	„	„	John Kelly	36	Miner	Fall of coal	*	–	1	–	–	–	1
51	June 13	„	„	„	Owen Meechan	60	Labourer	Stone from waggon	†	–	–	–	–	1	1
52	Aug. 1	„	„	„	Jas. Johnstone	40	Brusher	Fall of stone	72	–	1	–	–	–	1
53	„ 17	„	„	„	Thos. French	30	Roadsman	„	24	–	1	–	–	–	1
54	Sept. 19	„	„	„	Finlay Boyd	30	Miner	Explosion of gunpowder	14	–	–	–	1	–	1
55	Dec. 13	Birks	„	Darngavil Coal Co.	John Perrie	30	„	Fall of stone	23	–	1	–	–	–	1
56	June 21	Blackridge	„	Blackridge Coal Co.	John Clark	35	Brusher	Struck by shot	60	–	–	–	1	–	1
57	„ 14	Blairadam	Fife	Blairadam Coal Co.	George Hunter	35	Miner	Fall of coal	13	–	1	–	–	–	1
58	Dec. 2	„	„	„	Michael Brown	32	„	Fall of stone	*	–	1	–	–	–	1
59	Jan. 16	Bog and Home Farm.	Lanark	Hamilton McCulloch and Co.	And. Walkingshaw	25	„	Explosion of gas	†	1	–	–	–	–	1
60	June 21	„	„	„	Adam Pow	30	„	Crushed by hutch	†	–	–	–	1	–	1
61	Sept. 16	„	„	„	Ronald Stewart	28	Roadsman	Fall of stone	51	–	1	–	–	–	1
62	„ 21	„	„	„	And. Brown	14	Dirt-picker.	Fell down a stair	55	–	–	–	–	1	1
63	Dec. 2	„	„	„	Wm. Binnie	35	Miner	Fall of stone	29	–	1	–	–	–	1

* Still off.
† No information.

List of the Non-Fatal Accidents—*continued.*

No. of Accidents.	Date.	Name of the Mine or Colliery.	Where situate (County).	Name of the Owner or Company.	Persons injured.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Number of Days off Work, including Sundays and Holidays.	Persons seriously injured. Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.	Total.
64	Dec. 29	Bog and Home Farm.	Lanark	Hamilton McCulloch and Co.	Gavin Thomson	23	Bogie-man	Jammed by hutch	15	–	–	–	1	–	1
65	Sept. 13	Bridgeness	Linlithgow	Bridgeness Coal Co.	John McIntosh	60	Driver	Caught between waggons	*	–	–	–	–	1	1
66	Jan. 28	Broxburn	"	Broxburn Oil Co. (Lim.).	Hugh McCord	25	Miner	Explosion of gas	35	1	–	–	–	–	1
67	Feb. 10	"	"	"	James Denholm	28	"	Igniting powder	21	–	–	–	1	–	1
68	Apr. 25	"	"	"	Wilson McLean	14	Driver	Crushed by hutch	107	–	–	–	1	–	1
69	Nov. 30	"	"	"	Jas. Dunnachie	29	Miner	Fall of shale	31	–	1	–	–	–	1
70	Feb. 1	Burntisland	Fife	Burntisland Oil Co. (Lim.).	Geo. Anderson	32	Engine-man.	Fingers caught by pinion wheel	83	–	–	–	1	–	1
71	Mar. 9	"	"	"	Thos. Davidson	30	Fireman	Crushed by derailed hutches	46	–	–	–	1	–	1
72	" 24	Cadzow	Lanark	Cadzow Coal Co.	John Brady	18	Driver	Jumping out of haulage bogie	24	–	–	–	1	–	1
73	July 27	"	"	"	Edward McCarrol	22	Miner	Fall of roof	20	–	1	–	–	–	1
74	Sept. 14	"	"	"	Jas. McIlvane	38	"	"	23	–	1	–	–	–	1
75	Dec. 30	"	"	"	Agnes Linn	15	Dirt-picker.	Jammed by hutch	*	–	–	–	–	1	1
76	May 30	Calderhead	"	And. Darling	Thos. Williamson	22	Miner	Finger broken while loading tub	†	–	–	–	1	–	1
77	Mar. 23	Callendar	Stirling	Callendar Coal Co.	Henry Barr	24	"	Fall of stone	15	–	1	–	–	–	1
78	Oct. 11	Cambusnethan	Lanark	Thomas Barr	Jas. Robertson	25	"	Explosion of gunpowder	30	–	–	–	2	–	2
					Alex. Mallie	19	"		‡						

* Still off.
† No information.
‡ Did not resume work at colliery.

List of the Non-Fatal Accidents—*continued.*

No. of Accidents.	Date.	Name of the Mine or Colliery.	Where situate (County).	Name of the Owner or Company.	Persons injured.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Number of Days off Work, including Sundays and Holidays.	Persons seriously injured. Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.	Total.
79	June 19	Camelon	Stirling	John Dunn	Alex. White	41	Miner	Fall of coal	21	–	1	–	–	–	1
80	Aug. 28	Carberry	Edinburgh	Deans and Moore	Chas. Tennant	15	Driver	Jammed by hutches	13	–	–	–	1	–	1
81	July 17	Cardenden	Fife	C. C. M. Rattray	Henry Allan	31	Miner	Fall of coal	28	–	1	–	–	–	1
82	Jan. 20	Carronhall	Stirling	Carron Co.	John Taylor	30	"	"	119	–	1	–	–	–	1
83	Feb. 17	"	"	"	David Dow	17	"	Run over by waggon	*	–	–	–	–	1	1
84	July 19	"	"	"	Wm. McLuckie	22	"	Riding on rake of hutches	56	–	–	–	1	–	1
85	June 15	Champfleurie	Linlithgow	Linlithgow Oil Co. (Lim.).	Mark. Lothian	46	Driver	Caught by derailed hutch	15	–	–	–	1	–	1
86	Oct. 13	"	"	"	Duncan Smith	21	Runner	Hand crushed by buffer of hutch	68	–	–	–	–	1	1
87	Dec. 26	"	"	"	Wm. McBrians	28	Drawer	Jammed by carriage	*	–	–	–	1	–	1
88	Aug. 16	Climpy	Lanark	Climpy Coal Co.	John Ross	14	Labourer	Pulled off pithead scaffold	28	–	–	–	–	1	1
89	Sept. 30	"	"	"	Arch. Beattie	32	Driver	Caught by derailed hutch	41	–	–	–	1	–	1
90	Oct. 2	"	"	"	Sam. Greenshields	36	"	Fell off hutch	10	–	–	–	1	–	1
91	Apr. 24	Clyde	"	Wilson's and Clyde Coal Co. (Lim.).	Dan. McCartney	46	Fireman	Struck by runaway tubs	60	–	–	–	1	–	1
92	Oct. 2	"	"	"	John Mullen	37	Miner	Fall of coal	*	–	1	–	–	–	1
93	Dec. 26	"	"	"	Bernd. McGrory	35	"	"	*	–	1	–	–	–	1
94	June 8	Clydesdale	"	Gavin Whitelaw	Thos. Paterson	25	"	Explosion of gunpowder	8	–	–	–	1	–	1
95	Oct. 13	"	"	"	John McCutcheon	55	"	Fall of coal	*	–	1	–	–	–	1

* Still off.

List of the Non-Fatal Accidents—*continued.*

No. of Accidents.	Date.	Name of the Mine or Colliery.	Where situate (County).	Name of the Owner or Company.	Persons injured.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Number of Days off Work, including Sundays and Holidays.	Persons seriously injured.					
										Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.	Total.
96	Apr. 27	Cobbinshaw -	Edinburgh -	Caledonian Oil Co. (Lim.)	Alex. Lightbody	22	Miner -	Fall of shale - - - -	63	–	1	–	–	–	1
97	Feb. 11	Coltness -	Lanark -	Coltness Iron Co. (Lim.)	Jas. Gray -	77	Roadsman	Struck by hutch - - -	106	–	–	–	1	–	1
98	Apr. 11	„ -	„ -	„ -	Alex. Watson -	47	Miner -	Ignition of powder - -	60	–	–	–	1	–	1
99	Oct. 6	„ -	„ -	„ -	John Fleming -	33	Driver -	Caught by engine rake - -	*	–	–	–	1	–	1
100	Nov. 25	„ -	„ -	„ -	Robt. Clark -	51	Screenman	Run over by waggon - -	*	–	–	–	–	1	1
101	Feb. 27	Cornsilloch and Millburn.	„ -	Arch. Russell -	John Copeland -	22	Loco.-driver.	Scalded - - -	28	–	–	–	–	1	1
102	July 11	„ -	„ -	„ -	John McMillan -	26	Pony-driver.	Crushed by hutch - -	47	–	–	–	1	–	1
103	Sept. 11	„ -	„ -	„ -	John Mitchell -	33	Drawer -	Fall of side - - - -	*	–	1	–	–	–	1
104	„ 20	„ -	„ -	„ -	John Parkison -	30	Miner -	Explosion of gas - - -	41	1	–	–	–	–	1
105	Jan. 21	Cowdenbeath -	Fife -	Cowdenbeath Coal Co. (Lim.)	Stephen Foley -	33	Fireman	Overwinding - - -	231	–	–	1	–	–	1
106	Aug. 23	„ -	„ -	„ -	Wm. Martin -	33	Sinker -	Fell down shaft - - - -	*	–	–	1	–	–	1
107	Feb. 18	Crofthead and Fallahill	Linlithgow -	Peter Thornton -	Wm. Duncan -	40	Miner -	Returning on shot - - -	94	–	–	–	1	–	1
108	Sept. 22	„ -	„ -	„ -	John McFarlane	45	Roadsman	Derailed hutches on haulage road -	*	–	–	–	1	–	1
109	Oct. 25	„ -	„ -	„ -	David McKeown	22	Hammer-man.	Eye cut while cutting bolt - -	25	–	–	–	–	1	1
110	Dec. 23	„ -	„ -	„ -	Patrick Brannen	45	Miner -	Fall of stone - - - -	*	–	1	–	–	–	1
111	May 12	Dalbeath and Hill of Beath.	Fife -	Fife Coal Co. (Lim.) -	And. Peebles -	21	Shunter -	Run over by waggon - - -	224	–	–	–	–	1	1
112	June 2	„ -	„ -	„ -	Thos. Fairfull -	41	Miner -	Explosion of gunpowder - -	108	–	–	–	1	–	1

* Still off.

List of the Non-Fatal Accidents—*continued.*

No. of Accidents.	Date.	Name of the Mine or Colliery.	Where situate (County).	Name of the Owner or Company.	Persons injured.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Number of Days off Work, including Sundays and Holidays.	Persons seriously injured: Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.	Total.
113	Sept. 6	Dalbeath and Hill of Beath.	Fife -	Fife Coal Co. (Lim.)-	Wm. Press -	22	Fireman -	Explosion of blasting gelatine -	43	–	–	–	1	–	1
114	Oct. 24	,, -	,, -	,,	Thos. Ditchburn	56	Miner -	Fall of coal - - - -	77	–	1	–	–	–	1
115	Mar. 6	Dalmeny -	Linlithgow	Dalmeny Oil Co. (Lim.)	Matthew McBain	17	Hanger-on	Falling in front of tub - -	14	–	–	–	1	–	1
116	Dec. 5	Dalquhandy -	Lanark -	Waddell and Son -	George Clark -	22	Miner -	Fall of coal - - - -	*	–	1	–	–	–	1
117	Jan. 20	Darngavil -	,, -	Darngavil Coal Co. (Lim.).	Edwd. Corrigan	24	,, -	Fall of stone - - - -	90	–	1	–	–	–	1
118	May 29	,, -	,, -	,, -	Wm. Henry -	14	Drawer -	Explosion of gas - - -	7	1	–	–	–	–	1
119	Sept. 19	,, -	,, -	,, -	John Glen -	21	Miner -	Fall of stone - - - -	120	–	1	–	–	–	1
120	Aug. 15	Denend -	Fife -	Denend Coal Co. -	Jas. Sheddon -	29	,, -	,, - - -	‡	–	1	–	–	–	1
121	Jan. 23	Devon -	Clackmannan	Alloa Coal Co. -	Robt. Adamson -	17	Haulage-man.	Crushed between tubs - -	73	–	–	–	1	–	1
122	July 12	Dewshill -	Lanark -	Coltness Iron Co. (Lim.)	Jas. Brady -	52	Miner -	Explosion of gunpowder - -	34	–	–	–	1	–	1
123	June 29	Donibristle -	Fife -	Donibristle Colliery Co.	Chas. Wilson -	22	,, -	Fall of stone - - - -	113	–	1	–	–	–	1
124	July 25	,, -	,, -	,, -	Geo. Campbell -	53	,, -	Struck by wheel brae chain -	41	–	–	–	1	–	1
125	Aug. 19	,, -	,, -	,, -	Alex. Seath -	22	,, -	Fall of stone - - -	116	–	1	–	–	–	1
126	Sept. 12	,, -	,, -	,, -	Adam Greenhill	63	,, -	Fell over a bench - - -	*	–	–	–	1	–	1
127	Feb. 1	Drum -	Stirling -	Bonnybridge Silica and Fireclay Co.	Thos. Forrester-	21	Drawer -	Fall of roof - - -	150	–	2	–	–	–	2
					And. Paterson -	31	Miner -		2						
128	Nov. 3	Dundonald -	Fife -	Dundonald Coal Co. -	John Mathieson	32	,, -	,, - - -	*	–	1	–	–	–	1

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List of the Non-Fatal Accidents—*continued.*

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129	Nov. 20	Dunnikier -	Fife -	Walter Herd and Son	George Bruce -	50	Brusher -	Struck by a shot - - -	*	–	–	–	1	–	1
130	July 5	Durie - -	„ -	Fife Coal Co. (Lim.)	And. Christie -	19	Screenman	Injured by a waggon - - -	44	–	–	–	–	1	1
131	May 17	Earnock -	Lanark -	John Watson (Lim.)	Wm. McCaig -	34	Brusher -	Fall of stone - - - -	†	–	1	–	–	–	1
132	„ 19	„ -	„ -	„ -	James Renshaw	16	Miner -	„ - - -	56	–	1	–	–	–	1
133	„ 22	„ -	„ -	„ -	Dan. McCorgray	32	Waggoner	Thrown under cart - -	†	–	–	–	–	1	1
134	July 7	„ -	„ -	„ -	Robt. Steven -	25	Miner -	Fall of head coal - - -	63	–	1	–	–	–	1
135	„ 13	„ -	„ -	„ -	John Leitch -	20	„ -	„ „ - - -	70	–	1	–	–	–	1
136	„ 27	„ -	„ -	„ -	Adam Steven -	19	„ -	Struck by empty hutch - -	147	–	–	–	1	–	1
137	Sept. 4	„ -	„ -	„ -	Wm. Collins -	23	Reddsman	Fall of stone - - - -	28	–	1	–	–	–	1
138	Oct. 24	„ -	„ -	„ -	Michael McDermot	37	Miner -	Fall of head coal - - -	*	–	1	–	–	–	1
139	Nov. 17	„ -	„ -	„ -	Jas. Lawson -	14	„ -	Fell on road - - -	*	–	–	–	1	–	1
140	Dec. 18	„ -	„ -	„ -	Thos. Wilson -	17	„ -	Fall of head coal - - -	*	–	1	–	–	–	1
141	Sept. 29	Eddlewood -	„ -	„ -	John Woodrow -	26	Engineman	Fell on spur wheel - -	†	–	–	–	–	1	1
142	May 8	Elgin -	Fife -	Thos. Spowart & Co. (Lim.).	John Mitchell -	35	Miner -	Fall of coal - - - -	30	–	1	–	–	–	1
143	Oct. 11	Elphingstone -	Haddington	R. and J. Durie -	Robt. Percy -	43	„ -	Fall of stone - - -	*	–	1	–	–	–	1
144	„ 12	Fairhill -	Lanark -	Arch. Russell -	Henry McTurk -	20	„ -	Explosion of fire-damp - -	14	1	–	–	–	–	1
145	Dec. 13	„ -	„ -	„ -	Wm. Fotheringham	16	Pony-driver	Run over by hutches - -	*	–	–	–	1	–	1

* Still off.
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List of the Non-Fatal Accidents—*continued.*

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146	Mar. 6	Fairholm	Lanark	Hamilton Colliery Co.	Wm. Barr	22	Miner	Fall of roof	83	–	1	–	–	–	1
147	Apr. 6	Fence	"	Nitshill and Lesmahagow Coal Co.	Andw. Frew	30	"	Explosion of gas	14	1	–	–	–	–	1
148	May 23	Fordell	Fife	Fordell Trustees	Thos. Wright	21	"	Fall of coal	51	–	1	–	–	–	1
149	July 25	"	"	"	Jas. Parker	39	"	Fall of stone	120	–	1	–	–	–	1
150	Sept. 12	"	"	"	Wm. Hinshaw	35	"	Fall of coal	22	–	1	–	–	–	1
151	Oct. 24	Forkneuk and Hopetoun	Linlithgow	Young's Paraffin Light and Mineral Oil Co. (Lim.).	Wm. Newton	17	"	Explosion of gas	1	1	–	–	–	–	1
152	Dec. 16	"	"	"	Wm. Sharp	17	"	Struck by hutch on engine plane	15	–	–	–	1	–	1
153	" 18	"	"	"	David Nicoll	25	Drawer	Fall of roof	*	–	1	–	–	–	1
154	Sept. 19	Garriongill	Lanark	Coltness Iron Co. (Lim.).	Thos. Heron	50	Miner	Fall of coal	63	–	1	–	–	–	1
155	May 12	Gartness	"	Gartness Coal Co.	Saml. Wilson	39	Coal cutting machine man.	Fall of coal and roof	30	–	1	–	–	–	1
156	" 29	"	"	"	Ephraim McKay	42	Miner	Explosion of gas	42	1	–	–	–	–	1
157	Feb. 7	Grangemouth	Stirling	Grangemouth Coal Co.	Alex. Hoggan	21	"	Fall of roof	43	–	1	–	–	–	1
158	May 20	"	"	"	Peter Robertson	16	Pony-driver.	Jammed by hutches	*	–	–	–	1	–	1
159	July 22	"	"	"	Wm. McGregor	31	Miner	Fall of coal	31	–	1	–	–	–	1
160	Sept. 19	"	"	"	And. Ballantyne	14	Labourer	Foot crushed by waggon	*	–	–	–	–	1	1
161	June 29	Greenfield	Lanark	Arch. Russell	David Richardson	12	Miner	Fall of coal	52	–	1	–	–	–	1

* Still off.

List of the Non-Fatal Accidents—*continued.*

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										Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.	Total.
162	Aug. 31	Greenfield -	Lanark -	Arch. Russell -	John O'Brien -	33	Wood-drawer.	Fall of stone - - -	42	–	1	–	–	–	1
163	Sept. 1	" -	" -	" -	John Henderson	55	Miner -	Run over by hutch - -	73	–	–	–	1	–	1
164	" 5	" -	" -	" -	John Munse -	28	" -	Fall of coal - - -	91	–	1	–	–	–	1
165	" 18	" -	" -	" -	Jas. Waugh -	18	Pony-driver.	Jammed by tubs - - -	8	–	–	–	1	–	1
166	Dec. 8	Greengairs, North.	" -	Saml. Ritchie & Co. -	Wm. Dempster -	28	Sinker -	Rope slipped over flange of drum -	42	–	–	1	–	–	1
167	Feb. 22	Greenhill -	" -	Robert Young -	Wm. Wilson -	50	Miner -	Explosion of fire-damp - -	42	1	–	–	–	–	1
168	Dec. 2	Greyrigg -	Stirling -	Greyrigg Coal Co. -	Jas. Strang -	37	" -	Fall of stone - - - -	†	–	1	–	–	–	1
169	Mar. 16	Harthill -	Lanark -	Jas. Wood (Lim.) -	Alex. Melville -	54	Labourer	Struck by falling plank - -	†	–	–	–	–	1	1
170	July 28	Hassockrig -	" -	Coltness Iron Co. (Lim.)	Thos. Glencorse	47	Miner -	Fall of coal - - - -	69	–	1	–	–	–	1
171	Jan. 20	Haywood -	" -	Haywood Gas Coal Co.	Joseph Armstrong	44	" -	Fall of stone - - -	†	–	1	–	–	–	1
172	Mar. 16	" -	" -	" -	Alex. Wilson -	23	" -	Run over by tub - - -	†	–	–	–	1	–	1
173	June 24	" -	" -	" -	Saml. Donaldson	37	" -	Crushed by tubs - - -	†	–	–	–	1	–	1
174	July 18	" -	" -	" -	Stewart Chambers	17	Chain-runner.	" - - -	†	–	–	–	1	–	1
175	Apr. 6	Kelty -	Fife -	Fife Coal Co. (Lim.)	Robt. Cowie -	14	Hanger on	Knocked down by hutches - -	110	–	–	–	1	–	1
176	" 15	" -	" -	" -	Alex. Forrester -	38	Miner -	Fall of roof coal - - -	70	–	1	–	–	–	1
177	Sept. 16	" -	" -	" -	Archd. Hodge -	55	Roadsman	Crushed by hutch - - - -	23	–	–	–	1	–	1
178	Dec. 5	" -	" -	" -	James Brown	22	Drawer -	Pushed down incline by loaded tub -	*	–	–	–	1	–	1

* Still off.
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List of the Non-Fatal Accidents—*continued.*

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179	Feb. 28	Kingseat	Fife	Wallace Bros.	Jas. Watson	39	Engineman	Arm torn off by haulage rope	97	–	–	–	1	–	1
180	Mar. 25	„	„	„	Wm. Ewans	21	Miner	Fall of stone	40	–	1	–	–	–	1
181	Apr. 25	„	„	„	John Dickson	24	„	„	51	–	2	–	–	–	2
					James Dickson	20	„		104						
182	Nov. 30	Kinneddar	„	Fifeshire Main Collieries (Lim.)	Richd. Bernard	22	„	Fall of coal	14	–	1	–	–	–	1
183	Dec. 9	„	„	„	Wm. Sharp	20	„	Crushed by cage	*	–	–	1	–	–	1
184	Aug. 26	Kinneil	Linlithgow	Kinneil Coal and Coke Co.	Robt. Byrne	57	„	Run over by hutch	*	–	–	–	1	–	1
185	Sept. 2	„	„	„	J. B. Robertson	64	Fireman	Explosion of gas	21	1	–	–	–	–	1
186	Mar. 15	Knownoble	Lanark	Kerr and Mitchell	Jas. Russell	26	Miner	Explosion of gunpowder	‡	–	–	–	1	–	1
187	„ 4	Lassodie	Fife	Thos. Spowart & Co. (Lim.).	Jas. Coyle	50	„	Fall of coal	95	–	1	–	–	–	1
188	Apr. 8	„	„	„	David Guthrie	22	„	Fall of stone	102	–	1	–	–	–	1
189	Sept. 27	Lassodie Mill	„	Rosewell Gas Coal Co. (Lim.).	Andw. Rennie	28	„	„	84	–	1	–	–	–	1
190	Apr. 22	Lathallan	„	Thos. Brown and Sons	James Laing	32	„	„	29	–	1	–	–	–	1
191	Aug. 4	„	„	„	Jas. Berwick	40	„	Fall of coal	23	–	1	–	–	–	1
192	Apr. 5	Leven	„	Fife Coal Co. (Lim.)	Jas. Williamson	28	„	Fall of roof	24	–	1	–	–	–	1
193	„ 7	„	„	„	Thos. Ellis	19	„	Fall of coal	30	–	1	–	–	–	1
194	Oct. 14	„	„	„	Thos. F. Earle	25	„	„	86	–	1	–	–	–	1

* Still off.
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195	Nov. 1	Leven	Fife	Fife Coal Co. (Lim.)	John Duffy	19	Miner	Fall of roof	*	–	1	–	–	–	1
196	" 17	"	"	"	David Paterson	50	Labourer	Fell over coal heap	20	–	–	–	–	1	1
197	Jan. 31	Linrigg	Lanark	Linrigg Coal Co. (Lim.).	Hugh Paterson	27	Brusher	Fall of stone	45	–	1	–	–	–	1
198	Dec. 29	"	"	"	Robt. Henderson	30	Miner	"	*	–	1	–	–	–	1
199	Mar. 31	Little Raith	Fife	Lochgelly Iron and Coal Co. (Lim.).	Alexr. Cochrane	55	"	Fall of coal	28	–	1	–	–	–	1
200	April 21	"	"	"	James Muirhead	22	"	Fall of roof	42	–	1	–	–	–	1
201	Aug. 5	"	"	"	John Graham	45	Reddsman	Run down by haulage set	21	–	–	–	1	–	1
202	Sept. 22	"	"	"	John Herriot	29	Miner	Fall of roof	‡	–	1	–	–	–	1
203	Dec. 6	"	"	"	Jas. Paterson	45	"	Fall of coal	*	–	1	–	–	–	1
204	Jan. 27	Loanhead	Edinburgh	Shotts Iron Co.	John Porteous	26	Bottomer	Caught by carriage	150	–	–	–	1	–	1
205	Feb. 15	"	"	"	Richard Peacock	14	Drawer	Fall of stone	10	–	1	–	–	–	1
206	Feb. 23	"	"	"	Christy Vickers	44	Fireman	Fall of roof	28	–	1	–	–	–	1
207	June 8	"	"	"	Geo. Henderson	28	Miner	Fall of stone	42	–	1	–	–	–	1
208	Oct. 23	"	"	"	John White	25	"	Explosion of shot while lighting another	*	–	–	–	1	–	1
209	Nov. 28	"	"	"	Andrew Vickers	16	Pony-driver.	Crushed by tubs	*	–	–	–	1	–	1
210	Mar. 4	Lochgelly	Fife	Lochgelly Iron and Coal Co. (Lim.).	Donald McKenzie	19	Miner	Fall at face	27	–	1	–	–	–	1
211	Mar. 16	"	"	"	John Arthur	28	"	"	100	–	1	–	–	–	1

* Still off.
‡ Did not resume work at colliery.

List of the Non-Fatal Accidents—*continued.*

No. of Accidents.	Date.	Name of the Mine or Colliery.	Where situate (County).	Name of the Owner or Company.	Persons injured.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Number of Days off Work, including Sundays and Holidays.	Persons seriously injured. Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.	Total.
212	April 10	Lochgelly	Fife	Lochgelly Iron and Coal Co. (Lim.).	Robert Gray	52	Miner	Fall at face	57	–	1	–	–	–	1
213	June 20	„	„	„	Robert Fowler	58	Pit-wright.	Fell down shaft	82	–	–	1	–	–	1
214	„ 30	„	„	„	David Shand	28	Miner	Fall at face	*	–	1	–	–	–	1
215	Sept. 21	„	„	„	Thomas Allen	18	Drawer	Struck by tub	14	–	–	–	1	–	1
216	„ 30	„	„	„	James McNeil	57	Miner	Fall at face	*	–	1	–	–	–	1
217	Oct. 25	„	„	„	Alexander Kerr	40	„	„	48	–	1	–	–	–	1
218	Dec. 13	„	„	„	John Anderson	28	Shunter	Caught by waggon	*	–	–	–	–	1	1
219	„ 22	„	„	„	William Allan	35	Miner	Fall of roof	*	–	2	–	–	–	2
					James Raeburn	40	„		*						
220	Aug. 28	Loganlea	Edinburgh	John McCulloch	William Fleming	45	„	Fall of coal	42	–	1	–	–	–	1
221	Feb. 6	Lochhead	Fife	Lochhead Fireclay Co.	Henry Hunter	27	„	„	‡	–	1	–	–	–	1
222	„ 27	Longrigg West	Lanark	James Gemmel	George Christie	57	„	Fall of roof	56	–	1	–	–	–	1
223	April 18	„	„	„	Geo. McLuskie	18	„	„	42	–	1	–	–	–	1
224	Jan. 13	Lumphinnans	Fife	Cowdenbeath Coal Co. (Lim.)	Alexr. Berwick	61	„	Struck by tub	‡	–	–	–	1	–	1
225	„ 20	„	„	„	William Smith	50	Brusher	Fall of roof	152	–	1	–	–	–	1
227	April 10	„	„	„	Alexr. Ross	13	Drawer	Jammed by tub	42	–	–	–	1	–	1
228	„ 20	Mainbank	Lanark	George Burt	James Smith	19	Miner	Explosion of a shot	9	–	–	–	1	–	1

* Still off.
‡ Did not resume work at colliery.

List of the Non-Fatal Accidents—*continued.*

No. of Accidents.	Date.	Name of the Mine or Colliery.	Where situate (County).	Name of the Owner or Company.	Persons injured.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Number of Days off Work, including Sundays and Holidays.	Persons seriously injured. Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.	Total.
228	May 20	Mainbank	Lanark	George Burt	Thomas Gillespie	17	Miner	Fall of coal and stone	14	–	1	–	–	–	1
229	Feb. 7	Mauldslie	„	Waddell and Son	James Young	40	„	Fall of roof	†	–	1	–	–	–	1
230	Nov. 13	Manuelrigg	Stirling	Manuelrigg Coal Co.	James Thomson	33	Roadsman	Fell down shaft	‡	–	–	1	–	–	1
231	Dec. 22	„	„	„	John Baird	33	„	Fall of roof	23	–	1	–	–	–	1
232	June 8	Meadowfield	Lanark	William Black and Sons.	Charles Gallacher	38	Miner	„	88	–	1	–	–	–	1
233	May 8	Merryton	„	Merryton Coal Co.	Thomas Twaddle	42	Oversman	Explosion of a shot	7	–	–	–	3	–	3
					James Simpson	41	Roadsman		49						
					Arthur Hamilton	20	Miner		6						
234	June 22	„	„	„	Joseph Davidson	30	„	Fall of roof	72	–	1	–	–	–	1
235	Sept. 18	Monkland	„	Calderbank Steel & Coal Co. (Lim.).	William Crawford	22	„	Explosion of gas	14	1	–	–	–	–	1
236	Jan. 23	Morningside and Allanton.	„	Morningside Coal Co.	James Dunsmore	25	„	Fall of coal	103	–	1	–	–	–	1
237	„ 13	Mossband	„	Linridge Coal Co.	James Costello	15	Drawer	Fell into cage seat	36	–	–	1	–	–	1
238	Sept. 12	Mosside and Riddochhill.	Linlithgow	Gavin, Paul and Sons	John Harkins	34	Miner	Explosion of gunpowder	14	–	–	–	1	–	1
239	Nov. 18	„	„	„	John McKail	33	„	Fall of stone	*	–	1	–	–	–	1
240	May 1	Motherwell	Lanark	John Watson (Lim.)	Alexander Faulds	38	Roadsman	Explosion of gas	7	1	–	–	–	–	1
241	July 14	„	„	„	John Barr	19	Miner	Fall of stone	13	–	1	–	–	–	1
242	Oct. 28	„	„	„	Jas. Macdonald	65	Carter	Fell from cart screen	7	–	–	–	–	1	1

* Still off.
† No information.
‡ Did not resume work at colliery.

List of the Non-Fatal Accidents—*continued.*

No. of Accidents.	Date.	Name of the Mine or Colliery.	Where situate (County).	Name of the Owner or Company.	Persons injured.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Number of Days off Work, including Sundays and Holidays.	Persons seriously injured. Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.	Total.
243	Mar. 14	Muiravonside, Redford, and Blackston.	Stirling	James Nimmo & Co. (Lim.).	James Lammie	30	Miner	Explosion of gunpowder	‡	–	–	–	2	–	2
					William Davies	50	„		2						
244	Aug. 16	„	„	„	Hugh Glencorse	40	„	Fall of coal	24	–	1	–	–	–	1
245	Sept. 8	„	„	„	John Elliot	65	Bottomer	Fall of stone	*	–	1	–	–	–	1
246	July 5	Muiredge	Fife	Bowman & Co.	Thomas Berry	42	Pithead-man.	Struck by waggon sprag	28	–	–	–	–	1	1
247	Oct. 4	„	„	„	George Morris	33	Miner	Fall of roof	*	–	1	–	–	–	1
248	„ 20	„	„	„	Patrick Hughes	30	„	Chain breaking on wheel brae	40	–	–	–	1	–	1
249	Nov. 6	„	„	„	Walter Young	27	Shunter	Fell before waggon	*	–	–	–	–	1	1
250	Jan. 16	Newbattle	Edinburgh	Lothian Coal Co. (Lim.).	George Sneddon	45	Shaftsman	Crushed in cage seat	21	–	–	1	–	–	1
251	„ 26	„	„	„	John Sutherland	16	Drawer	Jammed by hutch	56	–	–	–	1	–	1
252	Sept. 18	„	„	„	John McKenzie	60	Miner	Fall of coal	†	–	1	–	–	–	1
253	„ 19	„	„	„	Peter Guy	33	Sinker	Fall of stone from shaft side	36	–	1	–	–	–	1
254	„ 22	„	„	„	Robert Potts	13	Coupler	Run over by tub	*	–	–	–	1	–	1
255	Dec. 5	„	„	„	George Hodge	30	Sinker	Explosion of gas	*	1	–	–	–	–	1
256	Jan. 13	Niddrie	„	Niddrie and Benhar Coal Co. (Lim.).	John Boyle	36	Miner	Fall of coal	60	–	1	–	–	–	1
257	Mar. 17	„	„	„	Denis Boyle	28	„	„	43	–	1	–	–	–	1
258	Aug. 8	„	„	„	John Keilan	50	„	„	68	–	1	–	–	–	1

* Still off.
† No information.
‡ Did not resume work at colliery.

List of the Non-Fatal Accidents—*continued.*

No. of Accidents.	Date.	Name of the Mine or Colliery.	Where situate (County).	Name of the Owner or Company.	Persons injured.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Number of Days off Work, including Sundays and Holidays.	Person seriously injured.					
										Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.	Total.
259	June 7	Penicuik	Edinburgh	Shotts Iron Co.	Alex. McCurdy	28	Miner	Fall of coal	40	–	1	–	–	–	1
260	" 30	"	"	"	John Tait	18	Pony-driver.	Jammed by tubs	42	–	–	–	1	–	1
261	Aug. 14	"	"	"	Wm. Milne	17	"	Run over by tub	40	–	–	–	1	–	1
262	Dec. 14	"	"	"	And. Ireland	60	Dirt-picker.	Fell into greaser's box	*	–	–	–	–	1	1
263	Jan. 7	Pentland and Straiton.	"	Clippen's Oil Co. (Lim.).	James Kerr	33	Miner	Explosion of gas	†	1	–	–	–	–	1
264	" 16	"	"	"	Thomas Murphy	36	"	"	‡	2	–	–	–	–	2
					Stephen McPartland.	27	"								
265	Feb. 3	"	"	"	Jas. Norman	43	Drawer	"	‡	1	–	–	–	–	1
266	Mar. 12	"	"	"	Jas. Moir	16	"	"	154	1	–	–	–	–	1
267	" 14	"	"	"	James McMillan	27	Fireman	"	‡	1	–	–	–	–	1
268	" 29	"	"	"	Wm. Dunce	27	Drawer	"	‡	1	–	–	–	–	1
269	Apr. 15	"	"	"	Wm. Hull	32	Miner	"	91	1	–	–	–	–	1
270	May 22	"	"	"	John Gibbons	30	"	"	‡	1	–	–	–	–	1
271	June 2	"	"	"	T. Mulholland	21	Drawer	"	‡	1	–	–	–	–	1
272	July 11	"	"	"	Pat. Coyne	22	Miner	"	‡	1	–	–	–	–	1
273	" 31	"	"	"	Jos. Clark	39	Fireman	"	91	1	–	–	–	–	1
274	Sept. 5	"	"	"	Jas. Peden	42	Miner	Fall of shale	‡	–	1	–	–	–	1

* Still off.
† No information.
‡ Did not resume work at colliery

List of the Non-Fatal Accidents—*continued.*

No. of Accidents.	Date.	Name of the Mine or Colliery.	Where situate (County).	Name of the Owner or Company.	Persons injured.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Number of Days off Work, including Sundays and Holidays.	Persons seriously injured. Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.	Total.
275	Sept. 7	Pentland and Straiton.	Edinburgh	Clippen's Oil Co. (Lim.).	Jno. Haggerty	32	Miner	Explosion of gas	‡	1	–	–	–	–	1
276	Oct. 13	„	„	„	B. Gaffney	30	„	„	82	1	–	–	–	–	1
277	„ 20	„	„	„	T. Cornwall	43	„	Fall of shale	‡	–	1	–	–	–	1
278	May 31	Philpstoun	Linlithgow	Jas. Ross & Co.	Wm. Weir	42	Fireman	Explosion of gas	48	1	–	–	–	–	1
279	Aug. 28	„	„	„	Alex. Fleming	32	Miner	Struck by shot	*	–	–	–	1	–	1
280	Nov. 20	„	„	„	David McLean	28	Fireman	Explosion of gas	52	1	–	–	–	–	1
281	July 4	Prestongrange	Haddington	Prestongrange Coal & Firebrick Co. (Lim.).	Arch. Penman	57	Miner	Fall at face	*	–	1	–	–	–	1
282	Oct. 28	Pumpherston	Edinburgh	Pumpherston Oil Co. (Lim.).	Jas. Tiggart	24	„	Explosion of gunpowder	4	–	–	–	1	–	1
283	Feb. 27	Quarter	Lanark	Colin Dunlop & Co.	Henry McKay	17	Pony-driver.	Foot caught by chain	60	–	–	–	1	–	1
284	Mar. 9	„	„	„	Jas. Watt	38	Miner	Fall of coal	144	–	1	–	–	–	1
285	Apr. 10	„	„	„	John McGrath	56	Reddsman	Fall of roof	†	–	1	–	–	–	1
286	Aug. 17	„	„	„	Robt. Inglis	42	Miner	Fall of coal	80	–	1	–	–	–	1
287	Oct. 23	„	„	„	David Ferguson	25	„	Explosion of gas	25	1	–	–	–	–	1
288	Nov. 30	„	„	„	John Rooney	21	Brusher	Fall of roof	*	–	1	–	–	–	1
289	June 28	Rameldry	Fife	Jas. Martin	Henry Mitchell	42	Miner	Fall of stone	‡	–	1	–	–	–	1
290	Jan. 14	Rawyards	Lanark	Rawyards Colliery Co. (Lim.).	Andw. Naismith	19	Drawer	„	203	–	1	–	–	–	1
291	Apr. 14	„	„	„	Jas. McGill	30	Miner	„	35	–	1	–	–	–	1

* Still off.
† No information.
‡ Did not resume work at colliery.

List of the Non-Fatal Accidents—*continued.*

No. of Accidents.	Date.	Name of the Mine or Colliery.	Where situate (County).	Name of the Owner or Company.	Persons injured.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Number of Days off Work, including Sundays and Holidays.	Persons seriously injured. Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.	Total.
292	Apr. 14	Rawyards	Lanark	Rawyards Colliery Co. (Lim.).	Jas. Menzies	35	Roadsman	Fall of stone	65	–	1	–	–	–	1
293	„ 15	„	„	„	John Patrick	41	Miner	Explosion of gas	42	1	–	–	–	–	1
294	Dec. 19	„	„	„	Joseph Aitken	37	„	Fall of stone from dirt bing	*	–	–	–	–	1	1
295	„ 25	„	„	„	John Simpson	16	Pony-driver.	Jumping from hutch	*	–	–	–	1	–	1
296	Oct. 4	Redding	Stirling	Redding Colliery Co.	Jas. Muirhead	35	Brusher	Fall of stone	*	–	1	–	–	–	1
297	Feb. 17	Rigside and Glespin.	Lanark	Rigside Mining Co.	David Stevenson	50	Miner	Fall of coal	†	–	1	–	–	–	1
298	Mar. 2	Rochsolloch	„	Airdrie Coal Co.	Alex. Farquhar	48	„	Fall of stone	74	–	1	–	–	–	1
299	„ 31	Rosewell	Fife	Rosewell Gas Coal Co. (Lim.).	James Duncan	22	Runner	Crushed by waggons	34	–	–	–	–	1	1
300	Apr. 7	Ross	Lanark	Thomas Barr	Chas. Cathcart	57	Miner	Fall of roof	‡	–	1	–	–	–	1
301	„ 8	„	„	„	John Adams	28	„	„	‡	–	1	–	–	–	1
302	June 6	Roughrigg	„	Robert Forrester	Thos. Lambert	12	Drawer	Crushed by tubs	†	–	–	–	1	–	1
303	Nov. 29	„ East	Stirling	„	Jas. Love	25	Miner	Struck by descending cage	37	–	–	1	–	–	1
304	Jan. 31	Shawfield	Lanark	Wilsons and Clyde Coal Co. (Lim.).	John McGaw	18	Pony-driver.	Fall of roof	103	–	1	–	–	–	1
305	Aug. 25	„	„	„	John Ross	21	Miner	Explosion of gunpowder	8	–	–	–	1	–	1
306	Oct. 9	Sheardale	Clackmannan	Rob. McAllister and Sons.	Jas. Harrower	60	„	Fall of stone	79	–	1	–	–	–	1
307	Sept. 27	Shieldhill	Stirling	Carron Co.	Jas. Reid	22	„	Explosion of shot	*	–	–	–	1	–	1
308	Jan. 20	Shotts	Lanark	Shotts' Iron Co.	Wm. Morrison	45	„	Fall of building	†	–	1	–	–	–	1

* Still off.
† No information.
‡ Did not resume work at colliery.

List of the Non-Fatal Accidents—*continued.*

No. of Accidents.	Date.	Name of the Mine or Colliery.	Where situate (County).	Name of the Owner or Company.	Persons injured.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Number of Days off Work, including Sundays and Holidays.	Persons seriously injured.					
										Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.	Total.
309	Jan. 11	Southrigg -	Lanark -	A. M. Graham -	Ebenr. Clark -	20	Miner -	Fall at face - - - -	190	–	1	–	–	–	1
310	Dec. 12	„ -	„ -	„ -	Thos. Hickey -	25	„ -	Struck prop when throwing back stone	8	–	–	–	1	–	1
311	Aug. 14	Spindleside -	„ -	Barr and Higgins -	John Gibb -	24	„ -	Run over by tub - - -	84	–	–	–	1	–	1
312	May 3	Springbank and Turdees.	„ -	Springbank Colliery Co. (Lim.).	Patrick Brannen	33	Brusher -	Fall of stone - - - -	†	–	1	–	–	–	1
313	Jan. 23	Stravenhouse-	„ -	Jas. Thornton (Trustees)	James Nicol -	26	Miner -	Fall of coal - - - -	†	–	1	–	–	–	1
314	Mar. 28	„ -	„ -	„ -	Jas. Brodie -	25	„ -	„ - - - -	†	–	1	–	–	–	1
315	May 27	„ -	„ -	„ -	David Graham -	28	„ -	Fall of coal and stone - - -	†	–	1	–	–	–	1
316	Mar. 24	Tillicoultry -	Clackmannan	Alloa Coal Co. -	Wm. Hunter -	54	„ -	Pick struck foot - - -	30	–	–	–	1	–	1
317	May 27	„ -	„ -	„ -	Peter Dunn -	25	„ -	Run over by waggon - - -	*	–	–	–	–	1	1
318	Mar. 30	Townhill -	Fife -	Townhill Coal Co. -	Jas. Herdman -	16	„ -	Fall of stone - - - -	50	–	1	–	–	–	1
319	May 24	„ -	„ -	„ -	Lawrence Allan-	35	„ -	Fall of coal - - - -	58	–	1	–	–	–	1
320	Sept. 18	„ -	„ -	„ -	Peter Russell -	50	Pithead-man.	Run over by waggon - - -	*	–	–	–	–	1	1
321	Dec. 1	„ -	„ -	„ -	Richd. Blackwood	18	Trimmer	Crushed by waggons - - -	‡	–	–	–	–	1	1
322	Jan. 26	Tranent -	Haddington	Jas. Waldie and Sons	Wm. Rodger -	50	Miner -	Fall of coal - - - -	90	–	1	–	–	–	1
323	June 1	„ -	„ -	„ -	John Murdoch -	22	Roadsman	„ - - - -	170	–	1	–	–	–	1
324	Apr. 24	Tyneside -	„ -	A. White & Co. -	Jas. Pringle -	46	Miner -	Fall of roof - - -	†	–	1	–	–	–	1
325	„ 6	Vogrie -	Edinburgh -	Vogrie Colliery Co. -	Jas. Hamilton -	42	„ -	Fall of coal - - - -	60	–	1	–	–	–	1

* Still off.
† No information.
‡ Did not resume work at colliery.

List of the Non-Fatal Accidents—*continued.*

No. of Accidents.	Date.	Name of the Mine or Colliery.	Where situate (County).	Name of the Owner or Company.	Persons injured.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Number of Days off Work, including Sundays and Holidays.	Persons seriously injured. Explosions of Fire damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.	Total.
326	Dec. 26	Wallyford	Edinburgh	Deans and Moore	Wm. Brackenridge.	28	Joiner	Struck by rope	*	–	–	–	–	1	1
327	Nov. 13	Wellsgreen	Fife	Fife Coal Co. (Lim.)	John Clark	40	Miner	Fall at face	*	–	1	–	–	–	1
328	Feb. 27	Wemyss	„	R. G. E. Wemyss	John Hogg	26	Runner	Struck by runaway tubs	60	–	–	–	1	–	1
329	April 5	„	„	„	Thos. Nicoll	41	Miner	Fall of coal at face	21	–	1	–	–	–	1
330	July 26	„	„	„	Alex. Westwater	35	„	Fall of roof	80	–	1	–	–	–	1
331	Dec. 26	Westrigg	Lanark	Westrigg Coal Co.	Harry O'Hair	18	„	„	*	–	1	–	–	–	1
332	Feb. 8	Whitehill	Edinburgh	Lothian Coal Co. (Ltd.)	James Gardiner	28	„	„	98	–	1	–	–	–	1
333	June 30	„	„	„	Wm. Twaddell Geo. Twaddell	60 20	„ Drawer	„	* 84	–	2	–	–	–	2
334	July 10	„	„	„	David Greenhill	14	Driver	Kicked by horse	98	–	–	–	1	–	1
335	Sept. 22	„	„	„	Wm. McGregor	52	Pithead-man.	Struck by piece of coal	105	–	–	–	–	1	1
336	Dec. 21	„	„	„	James Thomson	20	Drawer	Crushed by tub	*	–	–	–	1	–	1
337	April 4	Wilsontown	Lanark	William Dixon (Lim.)	John McKendrick	58	Miner	Fall of roof	†	–	1	–	–	–	1
338	Mar. 10	Wishaw	„	Glasgow Iron and Steel Co. (Lim.)	Wm. McMurdo	21	Driver	Fell before tub	151	–	–	–	1	–	1
339	Oct. 2	Woodend	Linlithgow	Coltness Iron Co. (Ltd.)	George Stewart	29	Miner	Run down by loaded tub	90	–	–	–	1	–	1
340	July 5	Woodmuir	Edinburgh	Woodmuir Colliery Co.	Robert Brown	38	„	Fall of roof	98	–	1	–	–	–	1
341	Sept. 13	„	„	„	Jas. Aitchison	37	„	„	22	–	1	–	–	–	1
									Totals	36	175	10	97	34	352

* Still off.
† No information.

APPENDIX D.

METALLIFEROUS MINES REGULATION ACT, 1872.

FATAL ACCIDENTS, and loss of Life arising therefrom, in the East Scotland District, during the Year 1893.

Date.	No. of Accidents.	Name of Mine.	Where situate (County).	Owner's or Company's Name.	Persons killed.	Reputed Age.	Occupation.	Cause of Death, and Remarks.	No. of Lives lost.					
									Explosions of Fire-damp.	Falls of Ground.	In Shafts.	Miscellaneous Underground.	Above Ground.	Total.
Apr. 19	1	Netherton -	Lanark - -	James Houston - -	Robert Lees - -	26	Miner -	Fall of limestone - - -	–	1	–	–	–	1
								Total - -	–	1	–	–	–	1

APPENDIX E.

METALLIFEROUS MINES REGULATION ACT, 1872.

List of the NON-FATAL ACCIDENTS causing serious personal injury, or arising from explosions of Gas, or of any explosive, or of any Steam Boiler in the East Scotland District, during the Year 1893.

No. of Accidents.	Date.	Name of the Mine or Colliery.	Where situate. (County.)	Name of the Owner or Company.	Persons injured.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Number of Days off Work, including Sundays and Holidays.	Persons seriously injured. Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.	Total.
1	Aug. 8	D'Arcy - -	Edinburgh -	Lothians Coal Co. (Lim.)	James Heriot -	29	Miner -	Fall of limestone - -	119	–	1	–	–	–	1
2	Nov. 9	Westfield -	" -	William Baird & Co. -	Thomas McGovern	39	" -	Explosion of blasting gelatine.	†	–	–	–	1	–	1
3	Dec. 18	Rothes - -	Fife - -	James Lowe - -	Alexander Patton -	35	" -	Fall of limestone - -	†	–	1	–	–	–	1
								Total - -		–	2	–	1	–	3

† No information.

Reports of Inspectors Assisting.

Bonny, Gardenside,
Uddingston, Glasgow,
26th February 1894.

SIR,

IN pursuance of section 20 of the Metalliferous Mines Act, 1872, I have the honour to report to you that during the past year I have exercised the duties of Inspector in the district of East Scotland, and that in so doing I have acted under the directions of Mr. J. B. Atkinson, the Inspector for that district.

I have, &c.,
ROBERT McLAREN.

The Right Hon. H. H. Asquith, Q.C., M.P.,
Her Majesty's Principal Secretary of State,
Home Department, Whitehall, London.

25, Queen Margaret Drive, Glasgow,
26th February 1894.

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I have, &c.,
HUGH JOHNSTONE.

The Right Hon. H. H. Asquith, Q.C., M.P.,
Her Majesty's Principal Secretary of State,
Home Department, Whitehall.

REPORT

OF

J. L. HEDLEY, Esq., H.M. INSPECTOR OF MINES

FOR THE

NEWCASTLE DISTRICT (No. 3),

TO

HER MAJESTY'S SECRETARY OF STATE,

UNDER

The Coal Mines Regulation Act, 1887, the Metalliferous Mines Regulation Acts, 1872 and 1875, and the Slate Mines (Gunpowder) Act, 1882;

For the Year 1893.

Presented to both Houses of Parliament by Command of Her Majesty.

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1894.

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REPORT on the INSPECTION OF MINES in the NEWCASTLE DISTRICT, comprising the North part of the County of DURHAM, the Counties of CUMBERLAND and NORTHUMBERLAND, and so far as the Metalliferous Mines Regulation Acts apply, the detached part of NORTH LANCASHIRE, for the year ending 31st December 1893.—JOHN L. HEDLEY, Esq.

SIR, Newcastle-upon-Tyne, March 1894.

IN compliance with section 43 of the Coal Mines Regulation Act, 1887, and section 20 of the Metalliferous Mines Regulation Act, 1872, I have the honour to forward to you my Report as Inspector in charge of the Newcastle District, for the past year.

So far as labour is concerned, the year may be considered to have been a fairly satisfactory one; for, although trade was very slack in the earlier part of the year, especially in Northumberland, and the collieries consequently on short time, the arrears have been fully made up in the latter months, an extra demand for coal having been created by the strike of collieries in the Midland counties. Happily this district has been free from labour disputes of more than merely local importance, and there can be no doubt that the men were not only well advised, but acted wisely in refusing to join in the struggle which unfortunately led to such distress throughout the country.

Taking the whole district for the last 10 years, the average annual output of mineral for each person employed underground was 379 tons, and for the year under notice 372 tons, or a reduction of only seven tons. This shows that the men are not only working steadily, but, as wages have increased considerably during the period under notice, their pecuniary position has improved in like proportion, and by regular work they are reaping the benefit of the higher wages.

The output of minerals under the Coal Mines Act has steadily increased, and for the first time for some years the hematite iron ore mines also show an improvement; but I regret to say that accidents have increased in a greater proportion, and the results are not as satisfactory as could have been wished.

As in previous years, I have had the able assistance of Mr. R. P. W. Oswald and Mr. G. F. Bell, and both have attended assiduously to their duties. A very large proportion of Mr. Oswald's time is devoted to the iron ore mines in Cumberland and Lancashire, and in addition to a week spent there by Mr. Bell, I have given 38 days to that portion of my district, principally amongst the iron ore mines. With the exception mentioned above, Mr. Bell has been engaged about the mines in North Durham and Northumberland.

COAL MINES REGULATION ACT.

Persons employed.

As compared with the previous year, there has been a slight decrease in the total number of persons employed in and about mines, but exclusive of those employed on private branch railways and tramways and in washing and coking coal, the figures being 66,479, and 66,511 respectively, or a decrease of 32. Cumberland and Northumberland employed respectively 131 and 275 persons less, whilst North Durham shows an increase of 374. In every county the difference was principally in the number of underground workers, and a reference to the table below will show that the number of persons employed underground has increased in the last 10 years at a much greater rate than has been the case with those engaged on the surface, the increase in the latter being 18 per cent. only, as compared with 30 per cent. in the former. It will be noticed, also, that the number of females employed about the mines has, in the same period, been steadily declining, falling from 409 in 1884 to 281 in the year under notice.

TABLE showing the NUMBER of PERSONS EMPLOYED in and about MINES under HEADINGS (A) and (B), as compared with the previous Nine Years.

County and Year.	Underground (A).			Above ground (B).							Total of (A) and (B).
	Male Persons.			Ages 12 to 13.		Ages 13 to 16.		Above 16.		Total (B).	
	Ages 12 to 16.	Ages above 16.	Total (A).	Boys.	Girls.	Boys.	Girls.	Females	Males.		
Cumberland - -	249	5,732	5,981	—	—	140	—	273	1,099	1,512	7,493
North Durham -	1,877	20,164	22,041	—	—	752	—	5	4,497	5,254	27,295
Northumberland - -	2,257	24,046	26,303	42	—	641	—	3	4,702	5,388	31,691
Totals for 1893	4,383	49,942	54,325	42	—	1,533	—	281	10,298	12,154	66,479
„ 1892	4,531	49,866	54,397	4	—	1,513	8	284	10,305	12,114	66,511
„ 1891	4,590	48,550	53,140	1	—	1,573	1	254	10,065	11,894	65,034
„ 1890	4,333	45,631	49,964	8	—	1,443	4	246	9,720	11,421	61,385
„ 1889	4,081	42,038	46,119	25	—	1,355	6	263	9,009	10,658	56,777
„ 1888	3,905	39,689	43,594	35	—	1,240	—	309	8,728	10,312	53,906
„ 1887	3,818	38,759	42,577	10	—	1,111	1	396	8,962	10,480	53,057
„ 1886	3,536	38,646	42,182	25	—	1,074	—	395	8,872	10,366	52,548
„ 1885	3,812	38,669	42,481	25	—	1,107	4	408	8,986	10,530	53,011
„ 1884	3,778	38,230	42,008	35	1	1,116	9	409	8,728	10,298	52,306

On private branch railways and tramways and in washing and coking coal, 1,951 persons were employed, a decrease of 52 on the previous year.

Mineral raised.

The production of mineral in the district is steadily on the increase, and last year saw the largest quantity yet brought to the surface, the total output amounting to 20,248,799 tons, of which 19,924,708 tons were coal. A comparison cannot fairly be made with the work done in 1892, as for three months in that year one half of the collieries were at a standstill in consequence of a strike; but taking the year 1891 we find that there has been an increase in the quantity of mineral raised of 544,512 tons. Cumberland and North Durham show an increase of 140,218 tons and 663,070 tons respectively, but the output in Northumberland was less by 258,776 tons. Fuller details are given in the following table:—

TABLE showing the QUANTITY of MINERAL raised as compared with the Nine preceding Years.

County and Year.	Coal.	Fireclay.	Oilshale.	Ironstone.	Sandstone.	Ganister.	Limestone.	Totals.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
Cumberland -	1,815,552	39,339	2,593	—	*200	2,037	—	1,859,721
North Durham -	8,996,368	147,398	—	—	—	—	—	9,143,766
Northumberland -	9,112,788	131,834	—	—	—	—	690	9,245,312
Totals 1893 -	19,924,708	318,571	2,593	—	200	2,037	690	20,248,799
„ 1892 -	17,828,351	295,938	1,981	—	—	2,079	836	18,129,185
„ 1891 -	19,338,455	356,450	4,026	—	—	2,761	2,595	19,704,287
„ 1890 -	19,253,280	364,587	7,698	—	2,295	2,414	836	19,631,110
„ 1889 -	18,861,335	344,741	—	571	—	4,559	848	19,212,054
„ 1888 -	17,915,571	302,213	—	761	—	3,092	766	18,222,403
„ 1887 -	15,310,026	236,411	3,669	1,037	—	5,053	203	15,556,399
„ 1886 -	16,462,491	265,643	—	1,067	—	2,015	1,176	16,732,392
„ 1885 -	16,427,529	320,939	—	773	†771	2,525	1,790	16,754,327
„ 1884 -	16,841,841	362,281	—	884	—	1,610	1,444	17,208,060

* Pyrites. † Copperas lumps.

Accidents.

There has, I regret to say, been a large increase in the number of accidents, both fatal and non-fatal, as compared with the previous year, there having been reported to me a total for 1893 of 385, an increase of 58, resulting in the loss of 86 lives and injuries to 312 persons, or an increase of 13 in the number of fatalities and of 44 in that of the injured. It should be noted, however, that seven of the deaths resulted from injuries received in the year 1892, and of this number five were, although recorded, accidents of a very doubtful nature. There

were, in addition, five other deaths of a similar character, making a total of 10, about which there was considerable doubt either as to whether injuries had been received or whether the deaths were the result of accidents known to have occurred. It is only fair that on the decease of a person engaged in a mine, or, in fact, elsewhere, that any reasonable doubt should be settled in favour of the relatives; but as it means a considerable pecuniary benefit to them, care should be taken that this latter consideration should, in coming to a decision, not be allowed to enter into the matter; for there is a growing tendency, in this district at any rate, as is shown by the list of deaths reported to me and not included in the list of accidents, to attribute to injuries received in the pit the deaths of persons who have palpably died from natural causes.

With the exception of one case, in which two lives were lost, the fatal accidents were accompanied by one death only.

Two deaths resulted from an explosion of fire-damp, 47 from falls of roof and side, 10 in shafts, 22 from miscellaneous causes underground, and 5 occurred on the surface.

A detailed list of all the fatal accidents is appended to this Report, but in some cases it will be necessary to furnish fuller particulars, which will be found under the different headings.

The accidents were distributed over the district as follows:—

County.	Number of separate Accidents.	Number killed.	Number injured.
Cumberland - - -	84	11	73
North Durham - -	125	35	96
Northumberland - - -	176	40	143
Totals - -	385	86	312

And they occurred in the different months as shown in the accompanying table:—

Month.	No. of separate Accidents.	No. of Deaths.	No. injured.
Injured in 1892 - -	7	7	—
January - - - -	25	3	23
February - - -	25	1	24
March - - - -	31	9	22
April - - - -	21	2	19
May - - - -	41	10	37
June - - - -	29	7	22
July - - - -	33	11	23
August - - - -	32	4	29
September - - -	28	9	20
October - - - -	45	8	39
November - - -	34	8	26
December - - - -	34	7	28
Totals - - -	385	86	312

Although the number of fatal accidents and deaths resulting therefrom were so much in excess of the previous year, it is satisfactory to note that the quantity of mineral raised per life lost is not far behind that for 1892, the figures being 235,358 tons and 248,345 tons respectively, or a decrease of 12,987 tons. On the other hand there has been a considerable decrease in the number of men employed per life lost, but this is accounted for by the fact that there was a strike of three months' duration in 1892 in the Durham portion of the district, and a consequent diminution in the number of accidents, thus showing better results than would otherwise have been the case. It is only fair to assume that if the pits are idle for three months the number of accidents is reduced in proportion, and as the full number of persons employed is given, an unfair comparison with other years is the result; hence, this plan of estimating the progress or otherwise of a district is a fallacious one; but as the quantity of mineral raised is in proportion to the time worked, and presumably, therefore, to the number of accidents, a fair comparison can be made from year to year, and it is on the latter basis that the calculations should be made.

The following tables show:—

1st, the ratio of fatal accidents and deaths to the number of persons employed and the tons of mineral wrought per accident and death from 1883 to 1893 inclusive;

2nd, the amount of mineral raised and number of persons employed per life lost from 1883 to 1893 inclusive, and averages for the previous 10 years and nine years respectively; and

3rd, the number of accidents under the different headings and percentages of total, with analysis of accidents from falls of roof and sides from 1883 to 1893 inclusive.

TABLE showing the RATIOS of FATAL ACCIDENTS and DEATHS to the number of PERSONS EMPLOYED and the TONS of MINERAL WROUGHT per Accident and Death from 1883 to 1893 inclusive.

County.	Mineral raised.	Persons employed.	Separate Fatal Accidents.	Lives lost by the Accidents.	Tons of Mineral wrought per Fatal Accident.	Tons of Mineral wrought per Life lost.	Persons employed per Fatal Accident.	Persons employed per Life lost.
	Tons.				Tons.	Tons.		
Cumberland -	1,859,721	7,493	11	11	169,065	169,065	681	681
North Durham -	9,143,766	27,295	34	35	268,934	261,250	803	780
Northumberland -	9,245,312	31,691	40	40	231,133	231,133	792	792
Totals and averages 1893	20,248,799	66,479	85	86	238,221	235,358	782	773
Totals and averages 1892	18,129,185	66,511	73	73	248,345	248,345	911	911
" 1891	19,704,287	65,034	70	77	281,489	255,900	929	845
" 1890	19,631,110	61,385	88	92	223,081	213,382	697	667
" 1889	19,212,054	56,777	66	75	291,091	256,160	860	757
" 1888	18,222,403	53,906	61	92	298,728	198,070	883	586
" 1887	15,556,399	53,057	60	69	259,273	225,455	884	769
" 1886	16,732,392	52,548	56	56	298,793	298,793	938	938
" 1885	16,754,327	53,011	50	91	335,806	184,113	1,060	582
" 1884	17,208,060	52,306	65	66	264,739	260,728	804	793
" 1883	17,420,322	49,782	70	72	248,861	241,949	711	691
Averages, 10 years	17,857,053	56,431	65·9	76·3	270,972	234,037	856	740
" " 1873 to 1882	14,575,508	47,839	—	68·1	—	214,031	—	702
" 9 years 1864 to 1872	11,492,800	30,492	—	80·5	—	142,669	—	378

TABLE showing the AMOUNT of MINERAL RAISED, and NUMBER of PERSONS EMPLOYED PER LIFE Lost from 1883 to 1893 inclusive, and AVERAGES for the previous 10 YEARS and 9 YEARS respectively.

YEAR.	Explosions of Gas.	Falls of Roof and Sides.	In Shafts.	Miscellaneous, Underground.	Miscellaneous on Surface.	Total.	Explosion of Gas.		Falls of Roof and Side.		In Shafts.		Miscellaneous Underground.		Miscellaneous on Surface.		For all Deaths.		Mineral raised.	Persons employed.
							Mineral raised per Life lost.	Persons employed per Life lost.	Mineral raised per Life lost.	Persons employed per Life lost.	Mineral raised per Life lost.	Persons employed per Life lost.	Mineral raised per Life lost.	Persons employed per Life lost.	Mineral raised per Life lost.	Persons employed per Life lost.	Mineral raised per Life lost.	Persons employed per Life lost.		
1893 - -	2	47	10	22	5	86	10,124,400	33,240	430,825	1,414	2,024,880	6,647	920,400	3,022	4,049,760	13,296	235,358	773	20,248,799	66,479
1892 - -	2	37	3	28	3	73	9,064,592	33,256	489,978	1,797	6,043,062	22,170	647,471	2,375	6,043,062	22,170	248,345	911	18,129,185	66,511
1891 - -	6	32	4	27	8	77	3,284,048	10,839	615,759	2,032	4,926,072	16,258	729,788	2,409	2,463,036	8,129	255,900	845	19,704,287	65,034
1890 - -	—	30	9	39	14	92	—	—	654,370	2,046	2,181,234	6,821	503,362	1,574	1,402,222	4,385	213,381	667	19,631,110	61,385
1889 - -	7	35	3	16	14	75	2,744,579	8,111	548,916	1,622	6,404,018	18,926	1,200,753	3,548	1,372,289	4,056	256,161	757	19,212,054	56,777
1888 - -	31	29	5	18	9	92	587,819	1,739	628,359	1,859	3,644,481	10,781	1,012,356	2,995	2,024,712	5,990	198,069	586	18,222,403	53,906
1887 - -	12	29	6	19	3	69	1,296,366	4,421	536,427	1,829	2,592,733	8,843	818,758	2,792	5,185,466	17,686	225,455	769	15,556,399	53,057
1886 - -	—	30	5	14	7	56	—	—	557,746	1,751	3,346,478	10,509	1,195,171	3,753	2,390,342	7,506	298,793	938	16,732,392	52,548
1885 - -	42	21	9	13	6	91	398,912	1,262	797,825	2,524	1,861,592	5,890	1,288,794	4,077	2,792,388	8,835	182,112	582	16,754,327	53,011
1884 - -	—	35	6	18	7	66	—	—	491,659	1,494	2,868,010	8,718	956,003	2,906	2,458,294	7,472	260,728	792	17,208,060	52,306
1883 - -	2	32	7	20	11	72	8,710,161	24,891	544,385	1,559	2,488,617	7,112	871,016	2,489	1,583,666	4,526	241,949	691	17,420,322	49,782
Averages for 10 years, 1873 to 1882	1·7	31·5	6·3	19·6	9	68·1	8,573,829	28,141	462,714	1,518	2,313,573	7,594	743,648	2,441	1,619,501	5,315	214,031	702	14,575,508	47,839
Averages for 9 years, 1864 to 1872 -	4·77	3·66	11·66	2·22	13·22	80·55	2,405,470	6,382	374,765	994	985,097	2,613	568,325	1,508	869,203	2,306	142,699	378	11,492,800	30,492

TABLE showing NUMBER of ACCIDENTS under the different HEADINGS, and PERCENTAGES of TOTAL, together with ANALYSIS of ACCIDENTS from FALLS of ROOF AND SIDE from 1883 to 1893 inclusive.

Year.	Explosion of Fire-damp.	Percentage of Deaths.	Falls of Roof at Face.	Falls of Side at Face.	Falls of Roof in Goaf.	Falls of Roof and Sides on Road-way.	Total Falls of Roof and Sides.	Percentage of Deaths.	In Shafts.	Percentage of Deaths.	Miscellaneous; Underground.	Percentage of Deaths.	Miscellaneous on Surface.	Percentage of Deaths.	Total Deaths.
1883 -	2	2·78	15	3	6	8	32	44·44	7	9·72	20	27·78	11	15·28	72
1884 -	—	—	18	4	5	8	35	53·03	6	9·29	18	27·27	7	10·61	66
1885 -	42	46·15	11	1	2	7	21	23·08	9	9·89	13	14·29	6	6·59	91
1886 -	—	—	15	5	3	7	30	53·57	5	8·93	14	25·00	7	12·50	56
1887 -	12	17·39	11	5	4	9	29	42·03	6	8·70	19	27·53	3	4·35	69
1888 -	31	33·70	10	4	4	11	29	31·52	5	5·43	18	19·57	9	9·78	92
1889 -	7	9·33	13	8	8	6	35	46·67	3	4·00	16	21·33	14	18·67	75
1890 -	—	—	13	7	4	6	30	32·61	9	9·78	39	42·39	14	15·22	92
1891 -	6	7·79	14	4	3	11	32	41·56	4	5·20	27	35·06	8	10·39	77
1892 -	2	2·74	22	4	3	8	37	49·32	3	4·11	28	41·09	3	2·74	73
1893 -	2	2·32	20	7	4	16	47	54·65	10	11·63	22	25·58	5	5·81	86

The fatal accidents on private branch railways, and in washing and coking coal, were three in number, and occurred as follows :—

One to a locomotive fireman, by being crushed between the buffers when coupling the workmen's carriage to the engine ; the second to a coke filler who was crushed between the wall of the loading stage and a waggon when lowering the latter ; and the last to a waggon rider, who fell from the front of the waggon as he was uncoupling the rope, and was run over and killed on a branch railway. With a view to preventing similar accidents to the last, an improved means of releasing the waggons has been adopted, which it is hoped may prove efficacious.

The number of persons employed per life lost was 650.

Explosions of Fire-damp.

The most serious and only fatal explosion of fire-damp during the year occurred at the Dunston Colliery, near Gateshead, on the evening of the 24th May, resulting in the loss of two lives and injuries to two other persons.

The owners are Messrs. John Bowes and Partners, Limited ; A. S. Palmer, Esq., is the head viewer, Mr. William Lee the certificated manager, and Mr. W. R. Handyside the under-manager ; and the workings are further supervised by the usual and a competent staff of under officials.

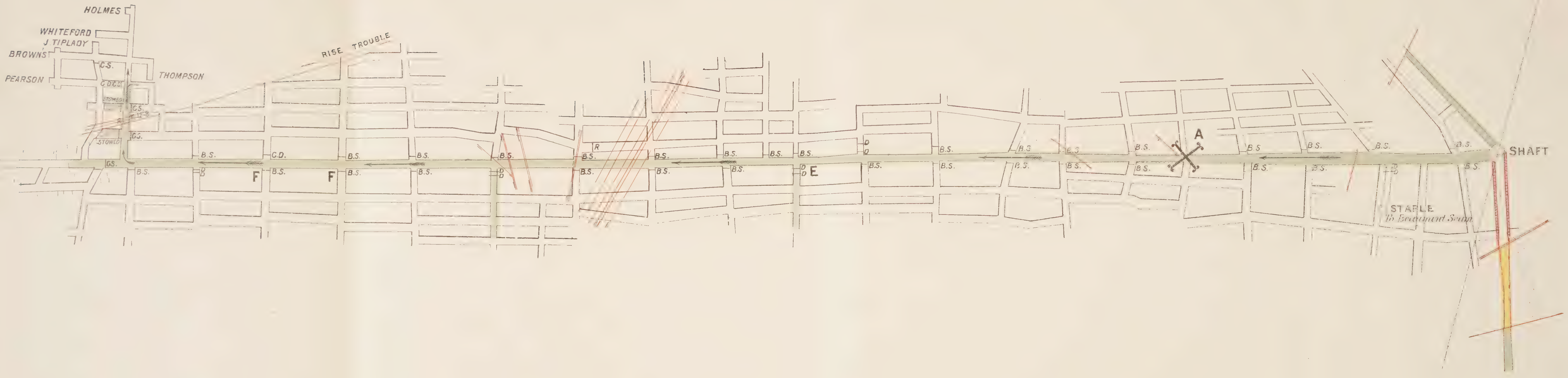
The seam in which the explosion occurred is the Brockwell Seam, and a plan, No. 1, of the portion of the workings affected, and an enlarged plan, No. 2, of the working places in the district in question, known as the South District, are appended hereto. No other part of the workings having been affected by the explosion, it is unnecessary to complicate matters by adding more to the plans than is requisite for the purpose of explaining the position of affairs on the night of, and the results of the accident.

At 5 p.m. on the evening of the 24th May four men, Robert Lowens, foreman stoneman ; Joseph Atkinson, stoneman ; George Fulthorpe and Thomas Courtney, putters, went down the pit for the purpose of blowing canch in the workings of the South District, compressed gunpowder being the explosive used. Lowens was engaged on the bottom canches in the working places, Atkinson at a top canch half way up the winning headways at 3, plan No. 2, whilst Courtney was putting the dirt from Atkinson to the stow bord at 4, plan No. 2, where Fulthorpe was engaged at the time of the explosion. The figures in black show the actual position of the four men, who were the only persons employed in the district that night, just before the accident ; and the figures in red mark the position where the bodies of the two deceased were afterwards found. The names on the body of the plan are those of the hewers who worked in the respective places during the day, and are inserted for the purpose of identifying the different working places.

It will be seen from the arrows that the ventilation passed direct from the shaft along the main waggon way to the bottom of the winning headways, thence to the point where Atkinson was working, where it split, a small portion, 6,000 cubic feet per minute, passing to the right to keep some old workings clear, whilst the larger quantity, 14,000 cubic feet per minute, was carried round the working places, six in number, in the district, and then proceeded direct to the upcast shaft. This measurement was made on the 16th May, but the evidence given at the inquest tended to show that the ventilation was in its normal state on the day of the accident, and that no gas was present in the district.

PLAN OF PORTION OF THE WORKING'S IN THE BROCKWELL SEAM.

DUNSTON COLLIERY.



REFERENCE.

Brick Stoppings shewn thus .... B.S.
Canvas .... „ .... „ .... „ .... C.S.
Canvas Doors „ .... „ .... „ .... C.D.
Wood Doors .... „ .... „ .... „ .... D.D.
General Course of Ventilation ...... ←

SCALE 2 CHAINS TO AN INCH.

Links 100 50 0 1 2 3 4 5 10 *Chains*

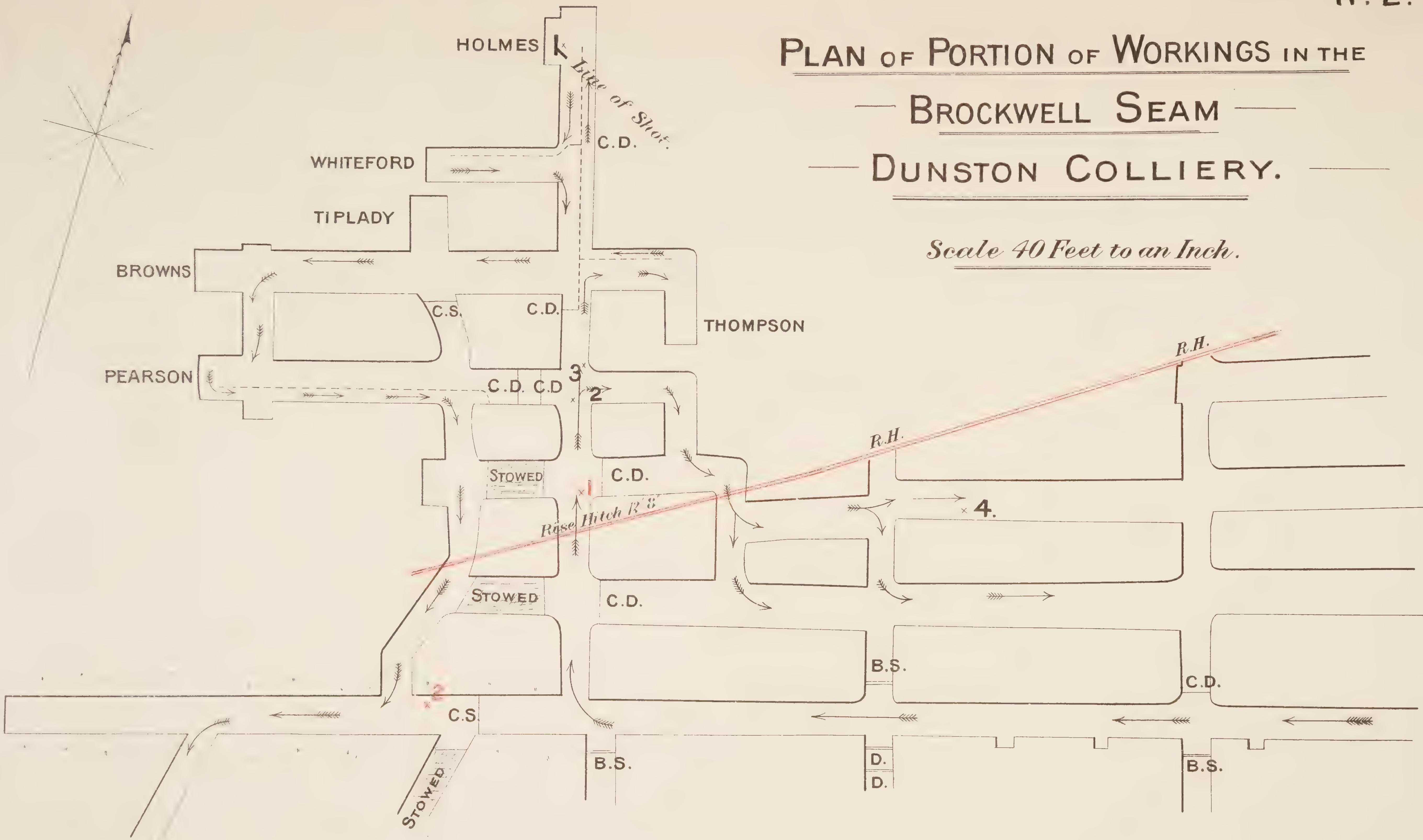
John L. Hedley

Judd & Co Ltd Lith. G3. Cam.

No. 2.

Plan of Portion of Workings in the Brockwell Seam Dunston Colliery.

Scale 40 Feet to an Inch.



Reference

Brick Stoppings Shewn thus	B. S.
Canvas " " "	C. S.
Wood Doors " " "	D. D.
Canvas Doors " " "	C. D.
Bratticing " " "	- - - -
*Direction of Air Current " *	←⋘
Names of Working Places Shewn thus	Holmes.

Places where Men Worked,

1. Robert Lowens
2. George Fulthorpe
3. Joseph Atkinson
4. Thomas Courtney

Place where Bodies Found,

1. Robert Lowens.
2. George Fulthorpe.

John T. Hedley

Judd & Cº Ltd. Lith. 63 Carter Lane

From the evidence of Atkinson it appeared that they had proceeded to their work as usual, everything going on well till 10 p.m., when there was a report of a shot, followed by a rush of air and sparks down the headways, knocking Fulthorpe and himself down. On recovering their feet both men hastened down the road together towards the shaft, but unfortunately Fulthorpe took the wrong turning, and passing through the cloth stoppings was suffocated by the afterdamp at the point marked 2 in red. Lowens managed to get as far down the headways as the point marked 1 in red on the plan, when he also fell a victim to the afterdamp; but Courtney, who was more severely burnt than the others, was successful in getting to the waggon way, and so out to the shaft.

It will be desirable, perhaps, to give here the short report of the result of the several inspections I made after the explosion, and which I submitted to the jury at the inquest, which was held by Mr. John Graham, Coroner for the Northern Division of Durham, at the colliery office, on the 5th July 1893. It was as follows:—

"Owing to my absence from Newcastle, being engaged in the Lancashire portion of the district, I was unable to visit the scene of the accident until the evening of the following day (Friday), 25th May, when, accompanied by Mr. G. F. Bell, inspector assisting; Mr. Lee, manager; Mr. Handyside, under manager, and other officials, I made a close examination of the district in which the explosion had occurred. Locked safety lamps are used in this seam, which, however, is not of a fiery description, gas being very rarely seen. Nor can it be called dusty, for, with the exception of a little dust on the packing at the roadsides near the face, it is conspicuous by its absence. Out of the coal itself water is constantly oozing, thus preventing the formation of coal dust.

"On leaving the shaft bottom the first indications of force were found at the crossing A, plan No. 1, where three planks had been displaced. This was at a point 172 yards from the shaft and about 700 yards from the face of the winning headways.

"At the way ends E, plan No. 1, 200 yards further in-bye, some notice papers had been blown from the board, but they were not charred at all.

"At the points marked F F, plan No. 1, two brick stoppings had been blown away from the waggon way, and, still further on a door had been damaged.

"Up to this point no signs of fire were apparent, nor were any seen until the winning headways was reached, when it was found that the coal side immediately facing the headways had been on fire. From this point inwards the presence of flame was shown by the coked dust on the inner side of the timbers, the quantity increasing by degrees up to Brown's bord, and beyond this point quickly decreasing. No coking was visible at the face of the headways and bords, but there were evident signs of heat.

"On an examination of the district it was seen that shots had been fired in Brown's bord and Tiplady's wall, both of which had been ridded, in the top canch, and Thompson's wall, which had not been ridded, and, apparently the last one, in Holmes' bord. No shot, it is important to note, had been fired in Whiteford's bord. All the lamps, with the exception of Lowens', were said to have been locked when found, and Lowens', although unlocked, had the top screwed on. From the position of his lamp and the general appearance of the place, it was evident that he had just fired the shot in Holmes' bord. This shot had, in my opinion, primarily been the cause of the accident; for although it had not only blown to the back of the hole but beyond it, it had not done its work in the usual manner; and an after examination showed that under the hole there was a slippery parting, and that the ground itself was also intersected by similar partings. It was found also that the hole had not been drilled in a proper direction, for, whereas the previous hole could be distinctly traced, nothing could be seen of that fired on the night of the accident. The result would be that when the shot was fired the flame would escape through these partings before the powder had time to do its work. This is not, however, sufficient to account for the force sufficient to injure a crossing 700 yards away, and it is necessary to look for some other agent to cause the damage. That agent, in my opinion, was fire-damp, for there was no mistaking the smell of after-damp, even 20 hours after the accident; but the question naturally arises, where did it come from? That fire-damp might be present is evident from the fact that there was an explosive mixture in Whiteford's bord at the time of my inspection, and although it may be urged that the ventilation was disarranged owing to the stoppings having been blown away (as was the case), still it shows that the same thing might occur in consequence of a derangement of the brattice; and considering that several shots, of which two were top canch shots, had been previously fired, it is not improbable that this has been the cause of the accumulation. From the appearance of the winning headways and Whiteford's bord I am inclined to think that there has been fire-damp in both these places, but only to a slight extent in the former, and this gas, ignited by the flame from the shot, communicated with the gas in Whiteford's place, so causing the explosion.

"A second inspection on the following day confirmed me in the view I have just expressed, and I was further convinced that the explosion could not have originated at any other point,

for what force there was all radiated from this point. An inspection of the return air-way leading to the stow-bord showed that the flame or heated air had passed along to the point where Courtney was working, and here an empty tub had been blown for a distance of two or three yards.

"This, with the exception of the stoppings, crossing, and the derangement of the brattice doors here and there, was the only sign of violence.

"After the necessary repairs were executed for putting the district in its normal condition, I made a further inspection, and found the ventilation in a satisfactory condition and the workings free from gas; and I can only account for its presence on the night of the accident on the assumption that the brattice had been displaced, whether by a shot or otherwise I cannot say.

"The deceased Lowens, who fired the shot, held a certificate authorising him to fire shots, but I would take this opportunity of referring to the fact that Atkinson, who also held a certificate, was a contractor, and it is doubtful whether he was a competent person within the meaning of the Act, which provides that 'In any place where safety lamps are used, or which 'is dry and dusty, the shots shall be fired by a competent person appointed by the owner, 'agent, or manager.'

"I am of opinion that such contractors are not competent persons within the meaning of the Act, though I do not for a moment suggest that any manager would appoint a man who was incompetent to fire a shot; but it is evident that if a contractor for blowing stone can hold a certificate for shot firing, there is nothing to prevent a contractor for getting coal, a hewer, from being granted the same privilege, and I do not suppose that anyone would contend that under the general rule referred to it was the intention of the Legislature to allow hewers to fire their own shots.

"I am aware that the same system is in force at other collieries, and it has been my endeavour hitherto to get it altered, and I trust that now it has come into such prominence that it will be the means of inducing those owners and managers who have hitherto allowed contractors to fire shots to adopt what was, without doubt, the intention of the Legislature when the Coal Mines Regulation Act was passed.

"This explosion also should teach one other lesson, and that is the great danger attending the use of gunpowder, whether in an apparently safe mine or otherwise, and it distinctly points to the desirability of abolishing the use of powder and substituting one of the high explosives, as has been advocated on so many occasions by those who have had to investigate similar accidents.

"I do not wish it to be inferred, however, that the higher explosives should be used in the absence of proper inspection, which, there is so much reason to believe, has been omitted on this occasion, and possibly, therefore, in the vicinity of fire-damp, but as an extra precaution, the want of which has resulted disastrously on so many occasions."

The jury returned the following verdict:—

"That the deceased died from accidental suffocation after a gunpowder shot had been fired, but whether suffocation was caused by ignition and explosion of gas or coal dust or both no sufficient evidence to the jury appears."

It will be seen from the verdict that there was some conflict of opinion as to the part coal dust took in this accident, and from the evidence of Atkinson, who, at the time of the explosion was only about 40 yards from the shot, it was a very fair assumption for the jury to arrive at that the dust, if not the sole cause, was at any rate instrumental in intensifying and developing the force of the explosion. Atkinson stated that he saw no flame, but only a few sparks passing him; but it should be borne in mind that at the time, he was standing up with his back towards the direction from which the blast came, that his head was above the level of the canch, and that between the two points there were two canvas doors across the roadway. He also had two lighted lamps close by, and it is quite possible, therefore, that although he might see sparks, the flame, which probably would not extend to any very great distance from the face, might escape his notice. That there had been flame in Holmes' and and Whiteford's places there could be no doubt, nor could there be any dispute as to the fact that there had been an ignition to a greater or less extent of coal dust, but, fortunately for the two men who escaped, neither fire-damp nor dust was present in any great quantity. At the point 4, plan No. 2, neither flame nor sparks were seen by Courtney, who was more severely burned than any of the others; and it is worthy of notice that although the return air road leading to the place where he was working was the driest and dustiest in the district, the signs of fire and coking of dust were less apparent than elsewhere. It is clear, therefore, that the explosion did not extend out-over along the return, and so cause the damage to the crossing at A, plan 1, and as in the other direction its force was apparently expended at or about the bottom of the winning headways, and the road from that point out to the shaft was entirely free from dust, it is difficult to account for the injury done to the crossing.

According to the medical evidence, neither of the deceased men were killed by the force of the explosion, but in both cases their deaths were due to asphyxia; nor were they very much burnt, as would have been the case had there been any considerable amount of dust ignited.

Whether the accident was due to gas alone, to dust alone, or to gas and coal dust combined, ignited by the flame from the shot, it conclusively shows, as I have stated before, the danger that will always attend blasting when gunpowder is used.

In addition to the foregoing, there were 10 non-fatal explosions of gas, resulting, fortunately, in but slight injuries to 10 persons, several of whom were able to continue at their work.

LIST of EXPLOSIONS of GAS in the NEWCASTLE DISTRICT in the Year ending December 31, 1893.

Date.	No.	Name of Colliery.	Where situate	Name of Seam.	No. killed.	No. injured.	Barometer, reduced to Sea Level.	Cause.
March 18th	1	Ashington	Morpeth	Low Main	—	1	30·20 Steadily rising.	A hewer went into a place other than that in which he was working, and ignited with his candle a small quantity of gas which had accumulated there. Cause, open lights.
May 24th	2	Dunston	Gateshead	Brockwell	2	2	30·05 Steady after slight rise.	*See* body of report. Explosion caused by the firing of a gunpowder shot.
„ 25th	3	Doctor Pit	Bedlington	Low Main	—	1	30·40 Steadily rising.	This accident was entirely due to carelessness. A stoneman had fired a shot, and on returning to the place he found on an examination with a safety lamp a slight trace of gas. He then fired a second shot, and, instead of using the safety lamp, entered the place with his candle, when there was an explosion, causing injuries to his face and arm. Cause, open lights.
June 23rd	4	Church Pit	Backworth	Yard	—	1	29·40 Steady after heavy fall.	Two putters were pushing an empty tub up a gateway, when a small quantity of gas exuding from a "breaker" in the roof ignited at their candle. One boy was slightly burnt, but not sufficiently to stop him from working, whilst the second was untouched. Cause, open lights.
„ 23rd	5	Church Pit	Backworth	Yard	—	1	29·40 Steady after heavy fall.	A similar case to the last. The tub caught against something, and on the putter raising his light, a small quantity of gas in a break in the roof was ignited, slightly burning him. The gas has been seen in the pit since. Cause, open lights.
July 7th	6	Ravensworth	Gateshead	Maudlin	—	1	30·10 Falling gently.	A hewer was driving a place through to an old bord which had fallen up, and, consequently, could not be examined, and on holing into it, a small quantity of gas came off, which exploded at his candle. It was stated that gas had not been seen in that district before, or lamps would have been used on approaching the old bord, which was unfortunately on the out-bye side of the new driving, hence the gas passing on to the man instead of away from from him. Cause, open lights.
Aug. 10th	7	South Tanfield	Stanley	Hutton	—	1	30·15 Steady.	A man was sent into a place to get out some plates, and on approaching the face, there was a slight explosion of gas. The deputy had just been in and examined the place, and found it clear, but an inspection shortly after showed that some coal had burst off the face from a "back," from which the gas had evidently come. Cause, open lights.
„ 25th	8	Montagu Fire-clay.	Scotsword	Tilley	—	1	30·30 Rising steadily.	A hewer had, early in his shift, holed into another place, and was then sent by the deputy to finish his day's work elsewhere. On the completion of his shift, he returned to his original working place for some purpose, and lighted up a small quantity of gas which had accumulated during his absence. The deputy stated that he had just examined the place, but if he had done so properly he could not have failed to find the gas. Cause, open lights.
Sept. 14th	9	South Medomsley.	Linty Green	Busty	—	1	30·20 Rising after sharp fall.	A shot had been fired about 8 p.m. on the previous evening, and at 10 p.m. the working place was inspected by the master shifter, who reported the place clear of gas. At 2 a.m. on the morning of the 14th September a shifter went into the place to "rid" the shot, when there was an explosion at his naked light. He was provided with a safety lamp, and had it with him, but, presuming on the general freedom from gas in the seam, he had foolishly carried his candle with him. Cause, open lights.
„ 18th	10	Seaton Delaval	Seaton Delaval	Yard	—	1	29·55 Steadily falling for some days.	A shifter was engaged in repairing the timbering in a long wall gateway, and was looking over the top of the timbering at a place where there had been a fall, when a small quantity of gas which had accumulated there ignited at his naked light. It was stated that gas had not been seen in the seam at this pit before. Cause, open lights.
Oct. 3rd	11	Ravensworth	Gateshead	Low Main	—	1	29·30 Steadily falling.	A hand pumper was slightly burned, but not sufficiently so to prevent his working out his shift, by the ignition of a small quantity of gas, which had apparently exuded from a "hitch" near to the place where he was working. Cause, open lights.

Falls of Roof and Sides.

Forty-seven fatal accidents, resulting in the loss of a like number of lives, were reported to me during the year. This shows an increase of 10 over the previous year and of 16 over the average of the preceding 10 years. Why there should be such an enormous increase in the number it is difficult to say, for an examination of the list of accidents will show that there has been no special cause for the fatalities, but that they have all been of the usual nature. It is true that many of them might have been prevented by the exercise of ordinary care on the part of those concerned, but it appears to be a difficult matter to convince the men, and in many cases, I am sorry to say, the deputies, that even with a good roof it is absolutely necessary to set timber systematically if this class of accident is to be prevented.

It is very probable that some of these accidents are directly, and others indirectly, due to a system which is peculiar to the counties of Durham and Northumberland, and which has been in existence from time immemorial. I refer to the "cavilling," and for the benefit of the uninitiated it will, perhaps, be as well to explain that "cavilling" is simply another word for balloting, and the object from the men's point of view is to give every one an equal chance of getting one of the better places in the pit, due perhaps to its proximity to the shaft, the nature of the coal, and many other circumstances which might render one place more desirable to work in than another. The "cavilling" takes place every three months, and is in some cases confined to the men in a particular seam; in others the men in two or three seams—no matter of what thickness—are cavilled together, and in some instances two or three pits are grouped together for the purpose. Whatever may be the benefit to the men financially, I do not pretend to say, but I think very few who know anything about coal mines, and consequently are acquainted with the varying nature of the roof even in the same seam, will deny that for men to be constantly moving from place to place and from one seam to another at such short intervals as three months is adding an element of danger which does not exist in other counties to those with which the men have naturally to contend. If the practice cannot be dispensed with, the risk should be minimised by "cavilling" each seam in every pit, and, if necessary, in every district, separately, and so ensuring as far as possible on the part of the men a more intimate knowledge of the nature of the seams and roof than they can obtain under the present system at so many collieries. At the same time, the men would retain whatever advantage there is to be gained from the custom.

Of the 47 deaths, 27, or $57\frac{1}{2}$ per cent., occurred at the working face, 16, or 34 per cent., happened on roadways, and 4, or $8\frac{1}{2}$ per cent., to deputies when drawing timber, and were due to over-confidence on their respective parts.

Shafts.

There was an unusual number of fatalities in shafts, the accidents amounting to 10, with 10 deaths, or nearly twice the average of the last 10 years. One occurred when ascending by machinery, four from falling from part way down, and five from miscellaneous causes. Some of the cases were purely accidental, others were caused by want of caution on the part of the deceased persons, but on no occasion, it is satisfactory to note, was there any defect in the plant or appliances. Particulars of each accident will be found in the list accompanying this report.

Miscellaneous Underground.

Explosions of Gunpowder, &c.

No deaths from this cause have to be recorded, but 32 separate accidents, resulting in injuries to 38 persons, were reported during the year. Fortunately, the injuries were, as a rule, of slight character; but, as will be seen from the accompanying list explaining shortly the nature of each accident, many of them might very easily have ended more disastrously to those concerned, who, in nearly every case, were themselves responsible for so long a list of regrettable and preventable accidents. In a large number of collieries in this district the shots are fired by the coal getters themselves, and "squibs" or "straws" are used for lighting up the charge. These are, to my mind, responsible for many of the accidents; for in their anxiety to get on with their work the men will persist in using the "squibs" or "touch" for the "straws" too short, which must inevitably lead in the long run to disaster to themselves and probably to some of their fellows. Another prolific source of danger results from the too hasty return into the working place after a shot has apparently missed fire; and as long as the present system of shot lighting continues we shall be liable, I am afraid, to a similar list of accidents year by year.

Several of the accidents were due to breach of rules, the most serious, and one that narrowly escaped a fatal termination, occuring at the Blenkinsopp Colliery, near Haltwhistle, where two stonemen deliberately, according to their own admission, broke the cartridge, and after pouring the powder into the hole were pushing it in with an iron scraper, when the charge exploded, no doubt in consequence of the scraper coming in contact with the rock and so causing a spark. In consideration of their severe injuries, no proceedings were taken against the men.

LIST of EXPLOSIONS of GUNPOWDER, &c. in the NEWCASTLE DISTRICT in the Year ending December 31, 1893.

Date.	No.	Name of Colliery.	Where situate.	No. killed.	No. injured.	Cause.
January 13th	1	Ashington	Morpeth	—	1	Filling a straw from the cartridge, when the latter was exploded by a spark from his candle.
„ 26th	2	East Holywell	Backworth	—	2	Blown out shot.
February 8th	3	Dudley	Cramlington	—	1	Not allowing sufficient time to get away from the shot.
April 6th	4	South Tanfield	Stanley	—	1	Explosion of a detonator with which a boy was playing. He refused to say where he got it from, but they were not used in the pit.
„ 19th	5	Throckley	Newcastle	—	1	Hammering a blunt pricker into a charge of compressed powder in a stone hole, when it exploded.
„ 28th	6	Shilbottle	Alnwick	—	1	A candle dropped from the side on to a cartridge that had been carelessly placed on the floor.
May 4th	7	Blenkinsopp	Haltwhistle	—	2	A stone hole was being charged with loose powder and an iron scraper, both contrary to rules, when it exploded, doing serious injury to two men.
„ 5th	8	Bedlington	Bedlington	—	1	A shot-lighter by some means lighted up a gunpowder shot when putting it into his case.
„ 6th	9	Rosegill	Maryport	—	1	Using too short a "touch" to the shot, which went off before the man could get away.
June 29th	10	Burradon	Killingworth	—	1	A deputy was charging a hole with bellite, when he evidently used too much force and exploded the detonator.
July 4th	11	Ashington	Morpeth	—	1	Returning to the shot too soon, thinking squib had missed fire.
„ 11th	12	Dudley	Cramlington	—	1	Ignition of shot by candle when being taken from cartridge box to "face."
„ 15th	13	Longhirst	Morpeth	—	1	Shot exploded prematurely while squib was being lighted.
„ 28th	14	Ravensworth	Gateshead	—	1	Carrying lighted candle and gunpowder shot in the same hand.
August 11th	15	Ouston "A"	Chester-le Street	—	2	Drilling a hole too near to one which had missed fire, when the drill struck the detonator.
„ 19th	16	Cowpen	Blyth	—	1	Using too short a squib, when the shot exploded before the man could get away.
„ 24th	17	Throckley	Newcastle	—	1	Candle too near the hole when it was being charged.
„ 25th	18	Seghill	Seghill	—	1	The paper bag burst when being put into the hole, and the powder ran out on to a candle which was just underneath.
„ 28th	19	Bedlington	Bedlington	—	1	A shot blew through into another plan and burnt the hewer working there. He knew the shot was to be fired, and retired, but did not go far enough away.
September 11th	20	Do.	Do.	—	1	Returning to shot too soon, thinking it had missed fire.
„ 13th	21	South Tanfield	Stanley	—	1	Shot exploded before the man could get away.
October 10th	22	Seghill	Seghill	—	1	The foreshift hewer left a missed shot in his jud and failed to inform his marrow, who cut into it with his pick and exploded the powder.
„ 13th	23	Ashington	Morpeth	—	2	Trying to force too large a cartridge into the hole.
„ 14th	24	Bedlington	Bedlington	—	1	Premature explosion of shot when the squib was being lighted.
„ 18th	25	East Holywell	Backworth	—		The cartridge burst when being put into the hole, and the loose powder fired at the candle.
November 27th	26	Ashington	Morpeth	—	1	A candle dropped into the shot box.
„ 29th	27	Walker	Newcastle	—	1	The battery carrier inadvertently attached battery and fired shot whilst the deputy was at the "face."
December 1st	28	Prudhoe	Prudhoe	—	1	Not sufficient time allowed to get away from shot.
„ 8th	29	Ashington	Morpeth	—	1	Returned too soon to the place, thinking the shot had missed fire.
„ 13th	30	Beamish	Chester-le-Street	—	1	Sparks from a candle dropped into the cartridge box.
„ 18th	31	Pegswood	Morpeth	—	2	The shot went off when the hole was being charged, but no particulars could be obtained from the men.
„ 26th	32	Hebburn	Hebburn	—	1	A shot was fired by means of a battery before the injured man could get away.
				—	38	

By Trams and Tubs and on Inclines and Engine Planes.

Under this heading I have to record a loss of 12 lives, and personal injuries to 88 others, as compared with 19 deaths, and injuries to 66 persons, in 1892; and although there has been a decrease in the fatalities, it will be seen that the total number of accidents has materially increased. As I have remarked in previous reports, it is a difficult matter to devise a means of preventing these accidents, as they occur more through recklessness and carelessness of the workpersons themselves than through any defect in the roadways, which I am glad to say are generally well looked after in this district; but I do not hesitate to say that if the "cavilling" system, which not only applies to the coal hewers, but to the pony putters, were, in the latter case, to be abolished, one serious element of danger would at once be done away with. Whatever arguments may be used in its favour when applied to hewers cannot possibly be urged in its favour in the case of pony putters, who vary more considerably in strength, and who should, therefore, be employed on the work they are most fitted to do. On the other hand, I am told that each lad, whatever his age and strength may be, should have an equal chance of working on the easy roads; and this, I submit, is an element of danger in itself, inasmuch as the younger lads would naturally become more exhausted in the course of their work on the heavier roads, and therefore be more liable to meet with accidents. The more serious source of danger, however, lies in the extension of the system; for the lads not only cavil for the flats or districts every three months, but they cavil for the roads on which they have to work on that "flat" every week or fortnight, and in some cases it is not only done after every shift, but the ponies are cavilled for also—that is to say, a pony and lad may be working on certain roads in the morning, and in the afternoon they are parted, and working on different roads altogether.

No one can conscientiously contend that the system is a safe or judicious one; nor do I think it would be supported on the ground of expedience or fairness, as the only ones, it appears to me, who benefit by it are the bigger lads, but then only to the danger of the younger ones. The custom is an old one, but bearing in mind the large number of accidents (25 per cent. of those reported) under this heading, of which two-thirds are by trams and tubs, it is quite time that attention should be drawn to the matter, with a view of getting some safer mode adopted than that at present in existence.

On Surface.

Of the five fatal accidents on the surface, one was caused by machinery, two by railway waggons on sidings, and two from miscellaneous causes; but in no case is it necessary to add anything further than will be found in the detailed list of accidents.

Supplementary List of Deaths Reported.

Numerous cases of deaths from causes which do not bring them within the category of deaths in and about a mine, and therefore not required to be reported, have come to my notice during the year; and a short description of each one is appended hereto. Seven deaths were due to heart disease.

On the 9th January, William Lydd, a shifter at Cambois Colliery, Blyth, died from paralysis, brought on, so it was stated, by an injury to his wrist, received in January 1891. It was difficult to trace any connexion between the so-called accident and his death, but in any case, as more than 12 months and a day had elapsed between the two events, it was not necessary to report it.

A sawmill man, James Muscrop, 67 years of age, fell dead in the yard at Cowpen Colliery, Blyth, on the 12th January.

25th January.—A boy, William Birtley, aged 15, was sliding down the hand-rail of the steps leading to the pit bank at South Derwent Colliery, when he overbalanced himself, and falling to the ground, received injuries to which he succumbed on the 25th February.

17th March.—A young girl, Rhoda Barnes, was picking coal on the Heworth Branch Railway, near Gateshead, when she was knocked down by the waggons, and was so injured that she died shortly after admittance to the infirmary.

Considering that many of these branch railways are practically public footpaths, and that so many women and children occupy their time in collecting the coal that falls from the waggons, it is surprising that accidents of this class are not of more frequent occurrence.

25th March.—A hewer, William Scawcroft, aged 22, died in the Whitehaven Infirmary, after undergoing an operation for rupture. It was stated that he strained himself in the pit

about a fortnight before his death, but there was no evidence of it, and it was known that the rupture was of long standing. No inquest was held.

11th May.—At Boldon Colliery, a shifter, Henry Bainbridge, aged 68, had finished his work, and was putting his clothes on, when he suddenly fell back, and died from syncope.

24th May.—George Strong had just come up the Benwell Pit, after finishing his day's work, when he fell dead from "heart disease" as he was crossing the gangway to the lamp cabin.

7th June.—A hewer, William Hetherington, aged 40, engaged at the "A" Pit, Bedlington Colliery, had walked out from his work, and when close to the shaft was seized with a fit, from which he never rallied, although every means were taken to restore him to consciousness. He appeared to be a strong man.

22nd June.—A hewer, named William Allan, employed at the Seaton Delaval Colliery, died from natural causes. An endeavour was made to connect his death with a slight injury he received in the pit in March, but the doctor stated that the accident had nothing to do with the death, and consequently no inquest was held.

6th August.—John Parsons, a shifter, 52 years of age, died suddenly on the pit bank at Heworth Colliery, when going to his work. The cause, according to the medical evidence, was from the rupture of an old aneurism, and not from an injury which it was stated after his death he had received in the pit.

13th August.—Thomas Nessian, a hewer, employed at Tanfield Lea Colliery. It was endeavoured to attribute his death to an accident in the pit, but, as the coroner reported to me, "there was absolutely no evidence of this."

21st August.—James Gallon, a miner, 37 years of age, was walking along the branch railway near to Springwell Colliery when he was run over by the waggons, and received severe injuries, from which he shortly afterwards died.

9th September.—Robert Patterson, employed at the Ashington Colliery, died of consumption. It was stated that his death was accelerated by an accident he received to his wrist about nine months before, but there was no evidence to that effect, nor had he ever mentioned it to any of the officials.

11th September.—Hugh Smith, a miner employed at the Wearmouth Colliery, died from erysipelas, the result of an injury in the pit, as stated by the relatives, but the jury were not satisfied, and whilst returning a verdict of "Accidental death," added "that there was no evidence to show where he had received the blow causing the erysipelas." The colliery officials had not been informed of any accident having occurred to the deceased.

21st October.—Norman Salmon, aged 14, whose father was in charge of the coke ovens at the Crosby and Gilcrux Collieries, near Maryport, and who occasionally assisted his father on a Saturday, though not engaged by the manager, was passing along a gangway leading from the coal hopper to the coke ovens, when he was caught by a loaded bogie, and jammed against a brick pillar. He had been told by his father to go home, and not to pass over the gangway on his way.

20th November.—Lewis Dix, a stoneman, 40 years of age, employed at the Wearmouth Colliery, Sunderland, died suddenly from syncope, following an acute attack of pneumonia. He had received a slight injury in the pit 10 days before, but the doctor said it had nothing to do with his death.

16th November.—William Robinson, a screenman, 63 years old, died suddenly in the fire hole from heart disease, a few moments after his arrival at the colliery.

2nd December.—Michael Glancy, pony driver, aged 16, was killed at the Marsden Colliery Station, South Shields, by falling between the platform and the footboard of the carriage. The men are taken to and from South Shields on the private branch railway, and it appears that the deceased, in his anxiety to secure a seat, endeavoured to get into the carriage before the train came to a standstill, with the result as stated above.

13th December.—A man named George Wardale was killed on the Cramlington private branch railway, by being run over by an engine. He was a trespasser, and had no business whatever on the line.

22nd December.—James Smith, a carter, 67 years of age, was employed by the owners of the Long Framlington Colliery, near Morpeth, to cart some material from the station to the colliery, and by some means, when about two miles from the colliery, he fell in front of the wheels, and was run over, dying almost immediately.

22nd December.—Joseph Stobart died of pneumonia. An effort was made to attribute the death to a colliery accident, but the medical evidence was directly opposed to that view, and the latter version was accepted by the jury.

Prosecutions.

I am glad to say that there was no occasion during the year to institute proceedings against owners, agents, or managers; but workmen were prosecuted for breaches of the Special Rules, &c., in the following cases:—

January 12th.—A hewer at South Tanfield Colliery, for improper treatment of his safety lamp, was fined 10*s*. and costs, 7*s*.

January 19th.—Three men employed at the William Pit, Whitehaven Colliery, were fined 1*l*. each, inclusive of costs, at the Whitehaven Police Court, for taking tobacco, pipes, and lucifer matches into the mine.

January 19th.—Six men employed at the Croft Pit, Whitehaven Colliery, were, for similar offences, fined at the same court 1*l*. each, including costs.

February 9th.—A putter at North Biddick Colliery was, at Gateshead County Police Court, fined 5*s*. and costs, 7*s*. 6*d*., for riding on a full sett of tubs without permission.

February 23rd.—At the Lanchester Police Court a hewer employed at Beamish Colliery was fined 20*s*. and costs, 7*s*., for sticking his pick into a safety lamp.

March 1st.—At Morpeth County Police Court a lad employed at Pegswood Colliery was fined 10*s*. and costs, 1*l*. 5*s*. 9*d*., for illtreating a pony by beating it on the head with a pick-shaft.

March 6th.—For continuing to use a damaged lamp at Wearmouth Colliery, a putter was at the Sunderland Police Court sentenced to two months' hard labour.

March 9th.—A putter employed at Beamish Colliery was fined at the Lanchester Police Court 5*s*. and costs, 8*s*., for going beyond a caution board.

March 29th.—A hewer employed at Wearmouth Colliery was fined at the Sunderland Police Court 2*s*. 6*d*. and costs, 7*s*. 6*d*., for having a tobacco pipe in the mine.

April 20th.—At the Workington Petty Sessions, a hewer employed at St. Helens Colliery was fined 2*l*., including costs, for not spragging his jud.

April 28th.—A hewer employed at Flimby Colliery was fined 12*s*. and costs, 8*s*., at the Maryport Police Court, for having a pipe in his possession in the mine.

May 17th.—Two hewers employed at St. Helens Colliery were each fined at the Workington Petty Sessions 1*l*., including costs, one for having lucifer matches in his possession in the mine, and the other for having a tobacco pipe.

May 18th.—A hewer employed at Walkmill Colliery was fined at the Whitehaven County Police Court 1*l*., including costs, for having his safety-lamp unlocked in the mine.

May 25th.—For not extinguishing his safety-lamp after it was damaged, a hewer employed at the Stargate Pit, Stella Colliery, was fined at the Gateshead County Police Court 5*s*. and costs, 7*s*.

June 27th.—For fighting in the pit at Wearmouth Colliery, a putter was fined at the Sunderland Police Court 5*s*. and costs, 9*s*, 6*d*.

July 26th.—Three hewers employed at Ravensworth Colliery, for riding on a full sett on the engine plane, were each fined, at the Chester-le-Street Police Court, 10*s*. and costs, 9*s*.

September 7th.—A hewer employed at Beamish Colliery was fined at the Lanchester Police Court, for having matches in his possession in the mine, 10*s*. and costs, 7*s*.

September 7th.—A putter employed at Usworth Colliery was prosecuted at the Gateshead Police Court for riding on a sett on the engine plane, but the case was withdrawn.

September 19th.—A hewer employed at Wearmouth Colliery was prosecuted at the Sunderland Police Court for having a lucifer match in his possession in the mine, but the case was dismissed.

September 25th.—A putter employed at the Church Pit, Backworth Colliery, was fined at the Tynemouth Petty Session, 2*s*. 6*d*. and costs, 10*s*., for fighting at the mine.

At the same court a flatter employed at the Maude Pit, Backworth Colliery, was fined 1*s*. and costs, 10*s*., for a similar offence.

September 27th.—A horsekeeper employed at Saint Hilda Colliery, for smoking in the stables underground, was fined at the South Shields Petty Sessions 2*l*. and costs, 12*s*. 6*d*.

October 17th.—For interfering with and assaulting the banksman when men were in the shaft, a hewer employed at Harton Colliery was fined, at South Shields Petty Sessions 1*l*. and costs, 17*s*. 6*d*.

November 2nd.—A hewer employed at South Tansfield Colliery was fined, at the Lanchester Police Court, 10*s*. and costs, 6*s*. 6*d*., for having his lamp within 2 feet of the swing of his pick.

November 7th.—A putter at Hebburn Colliery was fined, at the South Shields Petty Session, for carrying a damaged safety lamp without extinguishing the light, 10*s*. and costs, 7*s*.

November 30th.—A pony driver at Wearmouth Colliery was fined, at the Sunderland Police Court, 5*s.* including costs, for taking a tobacco pipe down the pit.

December 20th.—A hewing putter at Saint Hilda Colliery was prosecuted at the South Shields Petty Sessions, but not under the Coal Mines Regulation Act, for cruelty to a pony, and was fined 5*l.* and costs, 1*l.* 3*s.* 6*d.*

Exemptions.

An exemption from the provisions of Section 18 (ii) (*d*) of the Act was granted by you on the 16th day of November, to Mr. M. Stobart, owner of the Stublick Colliery, Langley-on-Tyne, Northumberland, on the ground that the quantity of mineral proved was not sufficient to repay the outlay that would be occasioned by making a second outlet. There are only five persons employed underground.

The only other exemption was one granted by me to the Consett Iron Company, Limited, Durham, from the provisions of General Rule 25, requiring the use of guides, and General Rule 27, requiring a cover overhead, in the case of some "staple" pits which are being temporarily used for the purpose of expediting the making of a water adit which is being driven to un-water a new coal field about to be developed by them.

Abandoned Mines.

In compliance with Section 38 of the Coal Mines Regulations Act, the plans and sections of abandoned mines or seams have been forwarded to you whenever the occasion arose for doing so, and after being compared with the originals, and if necessary corrected, were finally deposited at the Home Office for future reference. They were as follows, namely :—

March 17th.—Birkby Colliery, Maryport, Cumberland. Plan of No. 2 Seam, coal and fireclay, abandoned because not workable to a profit.

May 5th.—Todburn Colliery, Morpeth, Northumberland. Plan of Netherwitten Lower Seam, just opened, and abandoned on account of seam not turning out as well as was expected.

June 7th.—Walbottle Colliery, Coronation Pit, Northumberland. Plan of Splint Seam. Not profitable at time of abandonment. Royalty now taken up by the adjoining Throckley Colliery.

June 7th.—Frizington Colliery, Boghole Pit, Cumberland, Main Band Seam. Not profitable to work.

August 2nd.—Naworth Colliery, Midgeholme Pit, Cumberland. Plans of Midgeholme, Well Syke, Three Quarters, Low Main, and Yard Seam. Coal exhausted.

November 9th.—Lees Colliery, Haydon Bridge, Northumberland. A small drift working a thin seam, name unknown. Coal exhausted.

November 25th.—Coxlodge Colliery, Newcastle-on-Tyne, Northumberland. Plan of Low Main Seam. Colliery not profitable.

GENERAL REMARKS.

All fatal and serious accidents, and many of the minor ones, have been investigated with the view of finding out not only whether there was any negligence on the part of anyone, but whether anything could be learned which might tend in any way to prevent similar accidents in the future. The few complaints I received also had our attention, and any representations I had to make to the officials were promtply attended to. Many visits, both above and below ground, were made to the mines irrespective of accidents and complaints, in order to see that the provisions of the Acts and Special Rules were being enforced and carried out.

Mr. Oswald's time was occupied as follows :—280 visits to mines, of which 177 were to Metalliferous Mines, 103 of the latter being underground, as well as surface inspections. Of the 103 visits to collieries, 46 included underground inspections. Twenty days were occupied in office work, 13 inquests were attended, and for 13 days Mr. Oswald was confined to the house through illness.

Mr. Bell in the course of his duties travelled 8,393 miles by rail and road, and made 252 visits to mines, of which 126 included underground inspections. He further attended 38 inquests, and was engaged at 38 days at office work, meetings, &c.

My time, with the exception of a short holiday, was fully occupied with the multifarious duties which naturally arise in a large district like this. The correspondence is heavy, and as it all passes through my hands, a considerable portion of my time was taken up with office work. I also attended 31 inquests, made 101 underground inspections, in addition to those confined to general visits only, and attended at the Home Office, and at many meetings at Newcastle.

Apparently there has been a considerable reduction in the number of mines at work, but it is more fictitious than real. Several small landsale pits, chiefly in Northumberland, have been kept on the list in anticipation of their starting again, but the prospect of their doing so appears to be so remote, that I have thought it desirable to remove their names for the present.

There does not appear to be any further information to be gleaned from a study of the hours of the shift in which accidents occurred than has been gathered in the past years, but I append a table giving the particulars for the last three years, in order that a comparison may be the more readily made :—

Year.	Hours of Shift.											
	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11th	12th
1891 - -	7	12	6	5	8	17	8	2	—	6	1	1
1892 - - -	4	10	12	18	9	5	6	6	3	—	—	—
1893 - -	9	8	15	7	13	15	8	6	3	4	—	—

The figures as to the surface accidents quoted in my Report do not correspond with those given in a return issued by the Home Office on the 19th January 1894, as in the latter case three deaths of persons employed on private branch railways, and in washing and coking coal, have either inadvertently or through a misapprehension been included. These accidents can in no sense be called colliery accidents, and as it is not compulsory to report them, the figures cannot be relied upon as in the case of accidents in and about a mine. In many cases the coke ovens are far away from the mine, and have no connexion whatever with its working any more than in the case of manufactories for the production of " briquettes " made from the small coal in certain localities.

Again, in the case of branch railways, which extend in this district for many miles, an accident may happen 8 or 10 miles away from the mine, from causes entirely apart from anything essential to the working of a colliery. These branch railways as a rule are for the purpose of carrying the coal from the mine to the staiths for shipment at the different ports, and can in no way be called part of the mine. In fact, in one or two cases the waggons are taken for a certain distance over a private line, then over a public railway, and again over a private line, to the staiths. Private branch railways such as these do not exist in all the districts, where as a rule the pits are in close proximity to the public railways, and it is therefore necessary to make a distinction between those which, in the nature of sidings, are actually required to enable the colliery to be carried on, and those which serve the purpose in other districts of public railways.

The publication of the statistics as to accidents before those referring to quantity of mineral raised and persons employed are available, is liable to lead to misapprehension on the part of the public, who naturally look at the figures placed before them in the press without considering whether there are any other facts which should be taken into consideration in comparing the relative death-rates in the various districts—for instance, number of men employed, quantity of mineral raised, and, as in the case of last year, whether the collieries have been working full time or have been idle. It was estimated that one-half of the persons employed in mines were idle for nearly four month during last year, and it is only fair to assume that, had these men been at work, the mortality would have been greater than it was, and in publishing the return of accidents at an earlier date than the other mining statistics, those districts where work was continued appear at a disadvantage as compared with the others.

BOARD OF EXAMINERS. COLLIERY MANAGERS.

A vacancy on the Board occurred during the year through the resignation, on account of ill-health, of Mr. S. C. Crone, one of the representative mining engineers, and you were pleased to appoint as his successor Mr. T. H. M. Stratton. The Board is now composed as follows:—

John B. Simpson, Esq., Hedgefield House (Chairman)	Colliery owners.
George Baker Forster, Esq., Corbridge	Colliery owners.
T. W. Benson, Esq., Fourstones	Colliery owners.
A. S. Palmer, Esq., Gateshead	Mining engineers.
T. Taylor-Smith, Esq., Broadwood Park, Lanchester	Mining engineers.
T. H. M. Stratton, Esq., Cramlington	Mining engineers.
Mr. R. Elliott, Chester-le-Street	Miners' representatives.
Mr. A. Sharp, Maryport	Miners' representatives.
Mr. T. Weatherley, Pelton	Miners' representatives.
John L. Hedley, Esq., Newcastle-on-Tyne	H.M. Inspector of Mines.
M. Walton Brown, Esq., Neville Hall, Newcastle-on-Tyne.	Secretary.

The examiners are, as before:—

George May, Esq., Harton Colliery, South Shields.
John Simpson, Esq., Heworth Colliery, Gateshead.
J. G. Weeks, Esq., Bedlington Colliery, Bedlington.

There was a considerable increase, as compared with the previous year, in the number of those who presented themselves for the examination held at the Durham College of Science on the 5th and 6th January, there being 20 candidates, of whom 8 passed for first-class certificates, and 26 passes out of 60 who came forward for second-class certificates. In 1892 the numbers were as follows:—For first-class certificates, 3 candidates, 1 of whom only was successful; and for second-class certificates 46 candidates, of whom 28 satisfied the examiners.

Appended hereto, and by permission of the Board, are the questions put at the last examination:—

FOR FIRST AND SECOND CLASS CERTIFICATES.

No. 1 Paper. January 1893.

Time allowed—FOUR *hours.*

The working out of all questions must be fully shown. No answer giving simply the result will be accepted.

I. Arithmetic:—

Add—

1. Nineteen million nine hundred thousand and nineteen; one hundred and sixty million and six; ten million one thousand one hundred and one; three hundred and four million and forty thousand; ten million three hundred thousand and three.
2. Three thousand six hundred and seventy-four acres one rood and ten perches to four hundred and twenty-five acres two roods and nineteen perches.

Subtract—

1. 6,784,329 from 11,222,333 (giving your answer in words).
2. Eleven miles sixteen chains seventeen yards from twenty-four miles thirteen yards.

Multiply—

1. Six pounds four shillings and fivepence-halfpenny by three thousand seven hundred and twenty-four.
2. ·065341 by ·00475.

Divide—

1. 617*l.* 8*s.* 7$\frac{1}{2}$*d.* by 234·5.
2. The sum of $\frac{1}{4}$, $\frac{1}{3}$, and $\frac{3}{20}$ by the difference between $\frac{1}{5}$ and $\frac{1}{4}$.

II. Machinery :—

Describe, with sketches, the best examples of the following machinery with which you are acquainted, and give principal dimensions :—

1. Of a High Pressure Winding Engine.
2. Of a Condensing Pumping Engine.
3. Of a Boiler for High Pressure Steam (describing fittings and mountings necessary).
4. Ventilating Fan (and state its respective merits compared with other ventilating arrangements).
5. Of a Hauling Engine.

III. Pumping :—

1. Describe the action of lifting and forcing pumps, giving the terms used for all their parts.
2. A pumping engine goes seven strokes per minute, length of stroke 9 feet, diameter of pump 17 inches ; what is the quantity of water pumped per minute in gallons?

IV. Methods of working and ventilation :—

1. Sketch a district of bord and pillar workings for 20 hewers in a shift, and with the broken, following up the whole workings.
2. Sketch a long-wall district for 36 hewers in a shift.

In each case indicate the course of the ventilation by arrows, and show the position of all stoppings, regulators, and doors.

V. Timbering :—

1. Show, by plan and section, the method of timbering a $5\frac{1}{2}$-yard bord with a bad roof.
2. Show, by plan and section, the method of timbering and pillaring (the face of a gateway and two adjoining gateways for a distance of 10 yards back) in long-wall working.

VI. Measurement of air :—

1. Describe fully two methods of measuring an air current.
2. State the velocity at which you would have air travelling through the workings.
3. The current of air in a drift, 8 feet by 7 feet 2 inches, is such that powder smoke passes along a distance of 60 yards in 14 seconds. What is the number of cubic feet of air passing per minute?

VII. Safety-lamps :—

1. What description of safety-lamp are you familiar with ?
2. Describe it with a sketch, and state the points wherein you consider it superior or inferior to other safety-lamps.
3. How many apertures per square inch has the gauze ?

VIII. Explosives :—

1. Which explosive do you consider the safest for use in coal mines?
2. State your reasons, and explain what precautions you would take to prevent shots from blowing out.

IX. Coal Mines Regulation Act :—

State the regulations—

1. As to stations and inspections.
2. As to circumstances under which notice to the Inspector is required to be given.
3. As to books and registers required (give a list).
4. As to hours of employment of boys, girls, and women.
5. As to shot firing.

For First Class Certificates.

January 1893.

No. 2 Paper.

Time allowed—Four *hours.*

The working out of all questions must be fully shown. No answer giving simply the result will be accepted.

Sinking :—

1. Describe the method of sinking a shaft where quicksand is met with in the first 30 fathoms.
2. Give sketches and dimensions of the materials generally used while sinking through quicksand for a pit intended to be 12 feet diameter when finished.

II. Surface arrangements :—

Make a sketch showing the surface arrangements you consider necessary for a colliery having an output of 500 tons per day, and where there is pumping and ventilating machinery.

III. Underground arrangements :—

1. Draw a plan, showing how you would lay out the workings of a colliery for 125 hewers in each shift.
2. Give the number of men in each district.
3. State the quantity of air in each split, and indicate its course by arrows.
4. Show the position of all stoppings, crossings, doors, and regulators.
5. Show main ways and landings.

NOTE.—One-half the output to be from bords and pillars, and one-half from long-wall workings.

IV. Gases :—

1. What gases are met with in coal mines?
2. Give an account of their nature and properties.
3. Supposing a level drift, 70 yards long, to be filled with fire-damp at the most explosive point, and that the air and gas could be separated, what length of the drift would each occupy?
4. What amount of atmospheric air would render the above mixture non-explosive?

V. Ventilation :—

1. Explain the theory of the ventilation of mines, and why artificial ventilation is more reliable than natural.
2. Explain the rule which should be followed in splitting the air, and state what is the practical limit to the number of splits, and why?
3. How should a deputy or other responsible official proceed to remove an accumulation of fire-damp in a working place?
4. Should such official report the condition of the place as he found it or as he left it?

VI. Furnace :—

Sketch a furnace, suitable for 100,000 cubic feet of air per minute, giving its dimensions and relative position to the shaft.

VII. Barometer and thermometer :—

1. Explain the use of the barometer and thermometer.
2. How would you expect the gases in a mine to be affected by a fall or rise of the barometer?
3. How does a change in the atmosphere, indicated by the thermometer, affect the condition of a mine?

VIII. Haulage :—

1. Describe, with sketches, any system of mechanical haulage with which you are familiar.
2. Describe the method of working it.
3. Explain fully the method of attaching and detaching tubs at the several landings and other places where necessary.
4. Describe the method of working curves and junctions.

IX. Dams :—

1. What precautions are necessary in selecting the position and preparing the place for a dam capable of resisting a pressure of from 50 to 100 fathoms of water?
2. Sketch two such dams (giving the dimensions), one of timber and one of brickwork, for a place 6 feet high and 8 feet wide.
3. What is the pressure, in lbs. per square inch, due to a vertical column of water 75 fathoms in length?

X. Surveying and levelling :—

1. Describe the ordinary method of surveying, and the instruments employed.
2. In using the magnetic needle, what precautions have you to take in surveying and plotting?

3. Plot the following bearings, and state what should be the course and length of the seventh set, to tie with the beginning of the first set.

No.		Links.
1	S $47\frac{1}{4}$ E.	340
2	S $79\frac{1}{2}$ W.	160
3	S $30\frac{3}{4}$ E.	420
4	N $62\frac{1}{2}$ W.	710
5	N 41 E.	230
6	N $62\frac{1}{2}$ W.	340

4. Describe the systems of levelling you are acquainted with, and show how to keep a level book, and reduce the levels.

METALLIFEROUS MINES REGULATION ACT.

Persons employed.

The decrease in the number of men employed in metalliferous mines in this district still continues, and last year saw the smallest number at work for some years past. As compared with the previous year, there were 532 fewer persons employed, the number for the past year being reduced to 9,065 above ground and below ground. There were 365 less engaged in iron ore mining, the remainder of the deficit being due principally to the decline of the lead-mining industry, which is apparently in a state of collapse, in this district at any rate. Employment at the iron ore mines has been fairly steady, if we may judge from the output per man, as compared with previous years. In Cumberland it was 363 tons per man, or two tons under the average annual output of the past eight years, and in Lancashire 411 tons per man, or 21 tons under the average for the same period. The output per person employed underground in the former county has varied but little, but in Lancashire there has been a decrease for 1893 of nearly 20 per cent. as compared with 1886. The following table shows the number of persons employed as compared with previous years:—

TABLE showing NUMBER of PERSONS EMPLOYED in and about the MINES for the Years 1890 to 1893 inclusive.

Year.	Underground.			Above-ground.							Total Under-ground and Above-ground.
	Males.			Ages 10 to 13.		Ages 13 to 18.		Above 18.		Total.	
	Ages 13 to 16.	Ages above 16.	Total.	Males.	Females.	Males.	Females.	Females.	Males.		
1893	59	6,503	6,562	3	—	507	6	—	1,987	2,503	9,065
1892	96	6,838	6,934	10	—	575	—	—	2,078	2,663	9,597
1891	73	6,818	6,891	10	—	542	—	—	2,112	2,664	9,555
1890	101	7,159	7,260	15	—	514	7	—	2,379	2,915	10,175

Mineral raised.

The quantity of mineral raised exceeds that for 1892 by 29,179 tons, the increase being principally under the heading iron ore. Barytes and zinc show a slight improvement, but lead, on the contrary, is gradually on the decline, and it is feared that this will continue, for the low price of lead renders it impossible for the mines where lead alone is produced to be worked to a profit. Two of the largest of the mines in the district have been permanently closed during the year, and it is extremely probable that another will cease to work within a very short time. The copper mine at Coniston is still in course of development, and smelting works are being erected, which, it is expected, will very shortly come into operation.

TABLE showing QUANTITIES of MINERALS wrought in TONS for 1893 and Three previous Years.

Year.	Name of Mineral.									
	Iron Ore.	Barytes.	Copper Ore.	Lead Ore.	Zinc Ore.	Stone, Clay, &c.	Slates.	Gypsum.	Ochre.	Total.
1893 -	2,229,082	7,964	167	4,052	7,034	9	4,689	19,238	45	2,272,280
1892 -	2,200,402	7,156	74	4,731	6,815	—	4,463	19,310	150	2,243,101
1891 -	2,394,990	7,162	—	5,780	5,011	60	3,318	19,907	173	2,436,401
1890 -	2,399,626	5,849	—	6,168	4,869	54,919	2,978	20,854	97	2,495,360

Accidents.

There was a decrease of 12 in the total number of accidents reported, the figures being for 1893, 44; and for 1892, 56; but unfortunately the fatal accidents show an increase of two, the numbers being 12 and 10 respectively. The fatal accidents were due to the following causes: Five from falls of ground, four in shafts, one by explosion of gunpowder, and two to miscellaneous causes on the surface. As will be seen from the following table, there were again two accidents caused by explosions of fire-damp, both in the Lancashire iron ore mines, but in both cases the injuries were of a slight nature.

All of the fatal accidents occurred in the hematite iron ore mines, seven of the number being in the Lancashire part of the district, and the remaining five in Cumberland.

TABLE showing the NUMBER and NATURE of the FATAL and NON-FATAL ACCIDENTS in 1893 and the TOTAL NUMBERS for the Years 1886 to 1892 inclusive.

Nature of Accident.	Number of Separate Accidents.	Number killed.	Number injured.
Explosions of fire-damp - - -	2	—	2
Falls of ground - - - -	15	5	11
In shafts - - - - -	5	4	1
Explosions of powder, &c. - - -	7	1	6
Trams and tubs - - - -	—	—	—
Miscellaneous underground - - -	9	—	9
Machinery on surface - - -	—	—	—
Miscellaneous on surface - - -	6	2	4
Totals 1893 - -	44	12	33
„ 1892 - -	56	10	46
„ 1891 - -	65	12	54
„ 1890 - -	66	12	55
„ 1889 - -	64	16	48
„ 1888* - -	—	20	—
„ 1887 - -	55	15	40
„ 1886 - -	64	18	47

* Non-fatal accidents not recorded.

It will be seen from the above table that there has been a considerable reduction in the number of fatal accidents in the course of the last eight years, and it may perhaps be of interest to quote an extract from the report for the year 1886 of my predecessor, the late Mr. Willis, bearing upon this point:—

"Since I have had the assistance of Mr. Oswald, in addition to that of Mr. Atkinson, the important hematite iron ore mines in Cumberland and Lancashire have had more frequent inspection than heretofore. I have thus been able to have very many of the serious personal injury accidents investigated soon after their occurrence. Such additional inspection will, I hope, bear fruit in the future."

That such additional inspection has been justified by the results cannot be gainsaid, but the improvement could not have been accomplished without the willing co-operation of the owners and managers, who, I am glad to say, show a readiness to accept such suggestions as have been made to them with a view to the safety of their workmen, and from the reports made to me by Mr. Oswald, there is no doubt that a considerable improvement has taken place in recent years, not only in the ventilation, but in the arrangement of the mines generally. I do not wish the inference to be drawn that unlimited inspection is desirable, for to transfer the responsibility of the manager, who is presumably always on the spot, to an inspector, who would only be able to visit the mine occasionally, even if his visits were paid every month, would, I am afraid, have a disastrous effect on the efficient management of the mine by creating, as it were, a dual responsibility.

It cannot be denied, however, that there is still room for further improvement, and as a step in that direction it is imperative that some amendment of the present Metalliferous Act should be adopted without delay, especially with reference to the iron ore mines, in which large numbers of men are engaged. That such a course is necessary has been forcibly demonstrated in the case of several accidents, to which attention will be called hereafter.

Explosions of Fire-damp.

Two slight explosions of gas occurred on the 24th of June and 7th September respectively, at the Mouzell Mine, near Dalton-in-Furness, causing injuries in both cases to one man. In consequence of similar accidents in the previous year, safety-lamps were used for inspecting the working places in broken ground, and it was stated that this had been done in the first case, but that a little gas had collected during the day above the timbers, which ignited at a candle carried by one of the men.

In the second case, a little gas had accumulated at the top of a "rise" in whole ground, and this place not having been examined with a safety lamp, the gas was not discovered until the man entered with his naked light.

In future all "rises" will be inspected with safety-lamps before the men are permitted to enter.

Falls of Ground.

Although the accidents from this cause in the iron ore mines have been less than in previous years, they might have been still further reduced had there been a more efficient examination of the workings before the men commenced, and during the time they were at work; and I feel it my duty to once more draw your attention to the defects of the Metalliferous Act in this respect. That such examinations can be made is evinced by the fact that some such system is already in force in some of the mines, and with good results; and it is absolutely necessary for the safety of those who will not take care of themselves that more stringent supervision shauld be made compulsory in every mine. Had such a supervision been exercised in the case of No. 6 on the list, the accident would, in all human probability, not have happened, as it was conclusively shown at the inquest that a cursory examination of the place would have disclosed the danger.

Shafts.

Four fatal accidents, or one-third of the total number, occurred in shafts, and they were all of a preventable nature, two being caused either by neglect of, or misunderstanding of, signals, one by a rail being dropped down the pit, and the fourth by the breakage of a hemp "crab" rope. This latter case once more illustrates the necessity of having some compulsory rule for the examination of the plant and appliances about the mines, for under the present Act there is no provision whatever for such inspection, although so many valuable lives depend upon the soundness and efficiency of the appliances in use. The accident in question occurred at Croft Pit, Bigrigg, belonging to Lord Leconfield; and it will, perhaps, be desirable to give a report of the inquest held on the body of the deceased, not only to emphasise the remarks I have already made with respect to the amendment of the present Act, but with a view to drawing the attention of all those who are engaged in the management of the mines to the necessity of taking special care in the examination of one of the most important articles in use about a mine. The report of the inquest is taken from the "Whitehaven News" of November 23rd 1893.

The Inquest.

The Rope exhibited, and shown to be rotten.

The Inspector calls attention to an important Amendment wanted in the Metalliferous Mines Act.

An inquest was held on Tuesday afternoon, at the Seacote Hotel, before Mr. Gordon Falcon, coroner, and a jury, of whom Mr. John Mossop was chosen foreman.—Mr. J. L. Hedley, H.M. Inspector of Mines in charge of this district, was in attendance; and Mr. Davidson, manager of the mine, was also present. Mr. Webster represented Lord Leconfield.—The jury having viewed the body, the first witness called was Joseph Pattinson. He deposed: I work at Bigrigg iron ore mines, which belong to Lord Leconfield. I was working there on Sunday last, in company with William Jenkinson. We were working as joiners at a new shaft they are sinking, which was about 70 fathoms. We were working on Sunday in the shaft, putting a stage in for a lead ring to go round the shaft, for the purpose of collecting water. We were down at the depth of some 36 fathoms. We went down on a vat. There was a cradle, consisting of a staging supported by four chains attached to the end of the rope, from the top of the shaft. We had been on this staging for about an hour and a half, and had been raised up and lowered down several times. We were going down when the rope gave way. I seized a plank across the shaft and held on, and I had to hold on there until assistance came. The deceased fell with the cradle to the bottom of the shaft, a distance of over 30 fathoms. I could not see how much rope came down with us. I had never worked on this cradle before. We have used this rope before, but never for the same purpose. I would consider that the rope was strong enough to hold a hundred of us, if it had been sound. It was thick enough. We examined the rope as it went down the pit, and we did not notice anything wrong with it. We took it out of the joiners' shop, where it was kept, on Thursday; and Jenkinson put it on to the crab winch himself. I have since examined the place where it gave way. It is a break, not a cut. I never saw it tested with any weight, except when putting up the head-gear; there would not be a great deal of weight on it then. I should think as great a length would then be used as was used on Thursday. I know nothing about the age of the rope, or anything of that kind. Mr. Hough, overman, was there on the Sunday. The winch was worked by hand at the top. We signalled to the surface, and they raised us or lowered us as we desired.—By Mr. Hedley: The weight of the cradle and the four chains, and us two together, would be about 4 cwt. Since this rope had been put on, on Thursday, we had no heavier weight on, and it had not been tested in any way. I did not see the rope on Thursday. I did not examine the rope myself to see what state it was in. Mr. Hough generally examined these things, and so did Jenkinson. Mr. Hough told him to be careful about the rope. There were two ropes, and Mr. Hough asked Jenkinson which he would have. Jenkinson said he would rather have the old one, as it was softer and more pliable on the crab; when there isn't a big weight a new rope is bad to lap. The joiners' shop is a dry place, with a good draught through it. The rope had not been used since it was used for putting up the head-gearing. I had nothing to do with the examination of the rope. I trusted to Jenkinson, who was in charge of the work, and who was over me.—By the Coroner: I heard Mr. Hough tell Jenkinson to thoroughly examine the rope as he put it on to the crab.—By Mr. Webster: I believe the rope was brought in a cart, on Wednesday, from the joiners' shop. I saw the rope when it was put into the cart, but was busy at the time. I did not see it put on to the winch.—By the jury: The rope was not tested when it was put on to the winch. When we signalled the men at the top we were let down very gently. There was no fault in the lowering. We were let down by the engine to a certain point, and then got on to the staging.—John Marsh deposed: The deceased is my half-brother. His name is William Jenkinson, and his age 39. He leaves a widow and one child. Beyond identifying the body, I know nothing about the circumstances of this accident.—By Mr. Webster: He was a careful, steady, and circumspect man, and had been engaged at these mines for several years.—William Graham deposed: I live at Bigrigg. I am a banksman, and was working the crab-winch at the top of the shaft on Sunday. Postlethwaite was working with me. We let the deceased and Pattinson down. They got on to the cradle at 15 fathoms first, and they were working for about an hour and a half, and had several times eight fathoms more rope than the depth at which the rope broke. I examined the rope as it left the winch, and saw nothing ail it. It broke close up to the winch, like the snap of a gun. There was nothing to cut the rope at the place where it broke. It broke about a foot off the barrel of the winch. With the exception of them two selves, there had been nothing on the rope that morning. It looked like a new rope. I would have had no hesitation in going down on the rope. It is the usual thickness used for this purpose. Mr.

Hedley : That depends on the weight it has to carry, of course. You are only speaking of this particular case, not of pits and work in general.—Witness : No, but for work of this kind. I had used the rope that broke on Sunday, with Jenkinson, several times, putting pipes in. I was working the winch, and Jenkinson was working, not with Pattinson, but Thomas Holmes as a mate. That would be about three weeks ago, last time. But they were never quite so far in as this. — The Coroner : Pattinson said the rope had never been used since it was used for putting in the head-gear ?— Witness : But he was not there. That was another job. They only used about 20 fathoms on those occasions. A man named Isaac Wilson was helping me at the winch at that job. There was no fault with the rope then. Joseph Prince also worked with me one Sunday when the rope was used for this purpose. The rope is examined every time it is put on.—By Mr. Hedley : When the rope was used on previous Sundays, it was used at that pit, not at other pits. I am very near positive it is the same rope. I think it is the same rope from its appearance. I cannot swear to it. I cannot tell whether any particular person is appointed to examine the rope. I examined the rope that morning. Before the men went down I looked at it every length as it was paid out. Anybody can see a broken strand. Could you see the rope was good, bad, or indifferent, except for broken strands, by simply looking at it ?—Yes, I think I could. The rope could not catch anything. It was simply the weight of the cradle and the men on it that broke it. I examined the broken end of the rope afterwards. I don't know what I think about that. The rope was right enough ; at least I think so, but I would not like to say to a thing like that, you know. I don't know much about ropes.—By Mr. Webster : I think the rope was the same that I had used on previous Sundays, but I won't swear. I did not know that the rope was kept at the joiner's shop.—James Hough deposed : I am an overman at Bigrigg Pits. I was the overman in charge on Sunday last. Jenkinson and Pattinson descended the pit under my instructions that day. The rope that was used on Sunday is kept at the joiner's shop, some distance away from the pit. I had some conversation with the deceased on the Monday before as to which rope he should use. We were talking about this job, and I asked him which rope he would have, the hard one or the soft one. We had a hard one and a soft one, and I gave him his option which he would have. He decided to take the soft rope ; that was the rope they had on. The deceased had used that rope before, 12 months gone August since. That was for putting up the head-gear at the top of the shaft. It had never been used since then till now. It is not a fact that it has been used there several Sundays lately by Jenkinson and another man. We have no other soft rope that laps so easily on the winch and that the winchman might take for the same rope. The rope was used for putting up the head-gear, and was used once before that. It was there when I went there, about six years ago. It never seemed to have been much used. I gave Jenkinson instructions to examine the rope well as he put it on the winch.—By the Coroner : After a rope has been lying past for a long time like that do you never test them ?—Witness : I have never seen it done.—Is there any way you do test them ? Not that I am aware of.—A rope with the greatest care might deteriorate ?—Yes, it might ; but I always thought if you kept a rope dry you could not do anything more.—Portions of the rope were at this point produced.—Mr. S. Graves, one of the jury, said that was where the fault was, the rope was rotten, and as he spoke he demonstrated that it was rotten by breaking loose strands of it. Perhaps its 50 years old, Mr. Graves added.—The Coroner presented a piece of the rope to witness and asked him to fray it, and asked what he thought of it ?—Witness said when you got into the rope that way it was a bad rope.—The Coroner : That is rotten.—Witness said that part of the rope might have been in water.—The Government Inspector handed a portion of rope taken from the barrel, which he said would never have been in the water.—Witness said the strands should not be made in that way. He would call that a bad rope, examining it that way. That rope should have carried a ton if it had been sound.—The Coroner : Having examined the rope, can you give any other explanation than that the rope broke because it was rotten ?—Witness : No, I can't, after examining it like that.—The Government Inspector frayed a piece of the rope, and showed that it would tear to pieces with the fingers easily, being quite rotten.—The Coroner questioned witness about the ropes and the length of time they were used. He replied that he did not know anything about the stores. He used what was given him. This rope should bear a good deal more than a ton and a half when it was new. The rope at the particular place it gave way must have been extremely rotten, to give way with 4 cwt.—By Mr. Hedley : It is six years since I went there, and the rope has been there the whole time. I saw the rope put away in August. It was then dry. When it was used for pumping purposes the rope was damp, but not wet. It was put on boards and properly dried before being put away. I cannot account for the rope becoming rotten. I cannot say whether it must have been damaged before I came six years ago. I am responsible for these ropes. I could not say whether I have to examine them. Nobody examines the hemp ropes except those who are going to use

them, and me. I saw the rope on the winch on Sunday, but did not pull it off to examine it. —The Government Inspector: There's an old adage that what's everybody's business is nobody's business, and if nobody in particular has to examine the ropes they will never be examined. If you are responsible for the ropes, why do you leave it to the men to select their own?—Witness: The deceased had as much experience of the ropes as me. The rope that was used was much softer and not so long.—Haven't you a way of testing a hemp rope by cutting a bit off at the end to test it?—Witness: No, I never cut a bit off.—Do you know what the breaking strain of this rope would be when new?—Witness: I should say about 7 tons.—Mr. Hedley said the working strain was from 23 to 33 cwt., and the breaking strain was from 11 to 16 tons, according to Moulsworth.—Witness, replying to further questions, said if anybody said this rope had been used on previous Sundays, they were mistaken. He was satisfied that the rope produced at the place where it had broken had broken because it was rotten; he could not say anything else. There was no sign of any cut about it.—By Mr. Webster: This rope would get a certain amount of dampness in putting the pumps in. It was used for that purpose for several days. I am quite certain we dried it after that in the engine-house floor. It would be in the engine house drying, with a good through draught, for a week. It was then put away until it was used for the head-gear, when it was dried again after being used. The deceased selected the soft rope; he preferred it. He was an experienced man, and had been using ropes quite frequently, and in our pits.—By the Coroner: When I went down to the bottom of the shaft, after the breaking of the rope, I found deceased quite dead.—The Coroner: Is there anybody who can speak to the age of this rope?—Mr. Webster: No. I have tried to trace it, but I cannot.—Mr. Hedley, sworn, said he visited the Bigrigg pits this morning. The pieces of rope produced were what he took from a rope shown to him as having been that used at the time of the accident. He took a piece from the fractured end, and also a piece 15 yards above. He took other four pieces haphazard from the remainder of the rope. Those were the six pieces produced. He considered the rope rotten to the core, and the fact of it having broken as it did showed that it was rotten, to break with 4 cwt. on it, when it ought to have a breaking strain of at least 10 tons. There was no difficulty in examining a rope. He did not approve of testing by weights, but a rope could be safely examined by other means, one of which was to cut off a piece of the end and fray the strands.—The Coroner: Is there no provision under the Metalliferous Mines Act for the inspection of these ropes?—Mr. Hedley: Unfortunately there is not; and that is a point I should very much like to see drawn attention to more prominently. Under the Metalliferous Mines Act there is no obligation on any person whatever to examine ropes or machinery.—The Coroner: Neither ropes nor machinery?—Mr. Hedley: Neither ropes nor machinery. It is a very important point. It ought to be deputed to some competent person to examine these things daily; and until that is done it will be impossible to prevent occurrences of this kind. As I said before, what is everybody's duty is nobody's duty, and unless somebody is appointed for that particular purpose, the thing never gets properly done.—The Coroner: Under the Coal Mines Act these things have to be examined? —Mr. Hedley: Yes.—Mr. Webster: The pity is that the Coal Mines Act does not apply to metalliferous mines.—Mr. Hedley: I should hope to see, before long, a still more stringent Act for metalliferous mines. There is very little doubt in my mind that the rope must have been put by at some period of its existence in a moist state. It is mildewed, there is not the slightest doubt about it. I don't doubt what the last witness has stated about drying it and putting it away in a dry state. But it may have been damper than he imagined. It might apparently be dry. The engine-house was not always dry itself. I don't dispute his word for a moment. He probably thought he did what was best under the circumstances; but he may have erred like all the rest of us do occasionally.—The Coroner said the jury had now heard all the evidence in this case. They must not do anything to prejudice any question between the relatives and the owners of this mine in regard to any question of employers' liability. That was a matter that did not come within their province and the scope of their inquiry. What they had to inquire was how, when, and by what means this man came by his death, and whether any person was culpably responsible for his death. There could not be the slightest doubt that the man had come by his death in the pit shaft, not from any undue strain upon this rope, but from the absolute rottenness of the rope. The rope was evidently thoroughly rotten, and rotten to the core. It certainly did seem to him to be a very strange thing that a rope—they did not know the age of the rope, but it was not a new rope six years ago, that was certain—after having been used once three years ago, it was never used again till 12 months last August; and it certainly did seem to him to be strange procedure, it might be what was common in mines, or not, he did not know, but it did seem an extraordinary thing when a rope was used after having been lying away all these months, that some means were not taken to test the soundness of the rope before there were entrusted

to it a lot of human lives. Mr. Hedley told them there were simple means of testing the goodness or badness of a rope. However, it seemed that under the Metalliferous Mines Act it did not appear to be anybody's duty; and, although the overman considered himself responsible for the rope, he merely saw it when it was coiled on the barrel, and asked deceased to examine it before he put it on. Of course, the examination by deceased himself when putting it on the barrel, would not be such as would test the rottenness of the rope. As Mr. Hedley had said, and it really was a most important thing, there ought to be some provision in the Metalliferous Mines Act making it obligatory that some competent person should be made responsible for the examination both of the ropes and of the machinery. If, as Mr. Hedley said, there was no competent person whose special duty it was to do these sort of things, they did not get done at all, and this was the inevitable result. There was no duty cast upon the overman by the Act which he had neglected, but there was no doubt that it was while working in this shaft that the deceased met his death from the breaking of a rope, which was a rotten rope, and would not bear 4 cwt., when its breaking strain was at least 10 tons.—The jury having been left to themselves for a few minutes to consider their verdict, returned a verdict that the deceased came to his death by the breaking of a rotten rope whilst following his occupation in the shaft of a mine, and the jury wished to express their opinion that proper inspection of machinery and ropes under the Metalliferous Mines Act ought to be provided.—The Coroner said he would forward that recommendation to the Home Office.

Explosions of Gunpowder, &c.

The accidents from this cause were seven in number, resulting in the loss of one life and injuries to six other persons, and, as is usual with accidents of this nature, they were all due to want of care on the part of those concerned. In the majority of the cases, the fatal accident included, the men returned to their working places prematurely, thinking that the shot had exploded; but in two the fault was of a more serious nature, in one instance an attempt having been made to unram a shot, whilst in the other an iron pricker was being driven into a dynamite charge. As in the former case the explosive used was other than gunpowder no legal offence had been committed, and it affords another strong argument in favour of the amendment of the present Metalliferous Act.

In the meantime it is very satisfactory to report that the manager, Mr. Cedric Vaughan, of the largest mine in the district, the Hodbarrow Mine, at Millom, Cumberland, has, in view of the fatal accident which occurred in one of their pits on the 10th of July, anticipated any future legislation on this matter, and has issued such special rules as it is hoped will conduce very materially to the safety of those in his employ, and, with his permission, I append a copy hereto, in the hope that they may be adopted at other mines in the district.

Metalliferous Mines Regulations Act, 1872.

Copy.

Regulations as to Blasting.

General Rule No. 2.

Gunpowder or other explosive or inflammable substance shall only be used underground in the mine as follows :—

(*a.*) It shall not be stored in the mine.

(*b.*) It shall not be taken into the mine except in a case or canister containing not more than four pounds.

(*c.*) A workman shall not have in use at one time in any one place more than one of such cases or canisters.

(*d.*) In charging holes for blasting, an iron or steel pricker shall not be used, and a person shall not have in his possession in the mine underground any iron or steel pricker, and an iron or steel tamping rod or stemmer shall not be used for ramming either the wadding or the first part of the tamping or stemming on the powder or other explosive.

(*e.*) A charge which has missed fire shall not be unrammed.

Special Rules.

1. When a hole has been charged and the fuse lighted in any working place no person must enter that working place for at least 20 minutes afterwards, unless the charge has exploded.

2. When two or more holes have been charged in any one working place and all the charges have not exploded, no man must enter that working place for at least 20 minutes after the first shot went off.

3. When a hole has been charged the explosive shall not be unrammed, and it shall not be interfered with until a captain, timberman, or other authorised person has inspected the place and given instructions how to proceed.

Penalties Prescribed by the Act of Parliament..

Any person found guilty of any offence against the Metalliferous Mines Act is liable to a penalty of two pounds or imprisonment for three months with hard labour.

Hodbarrow Mines, August 1893.

On Surface.

The fatal accidents on surface were two in number, and they were both caused by trucks, but in neither case is it necessary to give further details than will be found in the accompanying list of accidents.

General Remarks.

As will be seen from the statements of work done by my assistants and myself, a very fair proportion of our time has been devoted to the metalliferous mines, principally those working iron ore. At least two-thirds of Mr. Oswald's attention, and a considerable proportion of mine, has been given to this industry, and I trust with beneficial results; and I hope that when our hands are strengthened by an amended Act still further improvement may be the outcome of our work in the future.

Two deaths, not comprised in the usual list of accidents, were reported during the year, the first on the 9th of February at the Wyndham Mine, Egremont, Cumberland, where a workman, Henry Rosewarne, 42 years of age, died suddenly in the pit from heart disease. From the same cause a quarryman, John Shaw, aged 60, died suddenly when at his work in the Moss Rigg Slate Quarry, Lancashire, on the 28th of August.

Prosecutions.

In no instance were proceedings instituted by me against either owners or managers, nor have I heard of any case in which any of the workmen have been prosecuted for a breach of the Act or Special Rules. This would have been done on two or three occasions, but the offending parties were so seriously injured that it was considered they had received sufficient punishment. In order, however, that the attention of their fellow workmen might be drawn to the serious nature of the offences committed, notices were posted about the works, as follows:—

"Caution.—I ______________, miner, hereby admit that on the 26th day of January last, I committed a breach of the rules of the ____________ Mines, in going back to my working place to light a second hole immediately after a first hole had exploded, whereby I nearly lost my life; and I hereby apologise for the said breach of rules, and promise that I will not offend in like manner again if the company will reinstate me in my employment.

"Signed ________________.

"Witness ________________."

It was also intimated that any future breach of the rules in question would be met by instant dismissal.

The publicity drawn to the case by the means mentioned above would no doubt have a salutary effect, and it would effectually prevent any man pleading ignorance of his duties when using explosives.

Exemptions.

No exemptions have been granted during the year on any ground whatever.

Abandoned Mines.

Plan and sections of abandoned mines were, in compliance of section 14 of the Metalliferous Mines Act, forwarded to the Secretary of State from the following hematite iron

ore mines, in which more than 12 persons had been ordinarily employed underground, namely:—

May 3rd.—Cleator, No. 11 Pit, near Whitehaven, Cumberland. Ore exhausted.

May 5th.—North Newton, Dalton-in-Furness, Lancashire, and Stainton, Bottom Heads and Stone Close Pits, Ulverston, Lancashire. Both abandoned on account of exhaustion of mineral.

May 13th.—Gutterby Mine, Egremont, Cumberland. Ore exhausted.

August 14th.—Mossbay, (Woodend Mines), Nos. 3 and 5 Pits, Egremont, Cumberland. Ore exhausted.

August 17th.—Dalton, Nos. 7 and 8 Pits, Dalton-in-Furness, Lancashire. Not profitable.

September 25th.—Clintz Pit, Egremont, Cumberland. Ore exhausted.

I append to this Report:—

1. List of fatal accidents under the Coal Mines Regulation Act, 1887, showing time and the hour of the shift in which the accident occurred.
2. List of fatal accidents under the Metalliferous Mines Regulation Act, 1872, showing the time and the hour of the shift in which the accident occurred.
3. Report by Mr. R. P. W. Oswald.
4. Report by Mr. G. F. Bell.

I have, &c.
JOHN L. HEDLEY,
H.M. Inspector of Mines.

The Right Hon. H. H. Asquith, Q.C., M.P.,
Her Majesty's Principal Secretary of State,
Home Office, Whitehall, London, S.W.

MINES CLASSED UNDER THE COAL MINES REGULATION ACT, 1887.

A LIST of the FATAL ACCIDENTS, and DEATHS arising therefrom within one year and a day from the date of the ACCIDENT, in MR. HEDLEY'S DISTRICT comprising the COUNTIES of NORTHUMBERLAND, CUMBERLAND, and the NORTH PART of DURHAM, during the year 1893.

No. of Accident.	Date and Hour of the Accident.	Hour of the Person's Shift, i.e., No. of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	No. of Lives lost.					
										Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.	Total.
1	1892. June 8 2.30 a m.	5	Whitburn -	Durham -	Harton Coal Co., Ld.	William Marsden	41	Deputy -	Enquiries made. In ascending or descending a "staple," a deputy who was with the deceased slipped and fell on to him. They were making an inspection of the mine previous to the pit starting work. Marsden died 30th March, 1893.	–	–	1	–	–	1
2	July 24	3	Hamsterley -	Ditto -	Hamsterley Coal Co.	Thomas Taylor -	16	Putter -	It is said that the boy got his head crushed between a tub and a prop on the night of the 24th July, but he continued at work until the 1st September without complaining. He died on the 16th February 1893, and it is doubtful whether the accident had anything to do with his death.	–	–	–	1	–	1
3	Oct. 19 1.0 a.m.	6	West Sleekburn.	Northumberland	Bedlington Coal Co. -	John Bell -	65	Shifter -	Inquest attended. It seems that he was lifting some stone, when he slipped and was caught against a prop. He complained of an injured finger, and afterwards of a pain in his side, and died on the 12th January 1893, possibly from the injury received.	–	–	–	1	–	1

List of Fatal Accidents—*continued.*

No. of Accident.	Date and Hour of the Accident.	Hour of the Person's Shift, *i.e.*, No. of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	No. of Lives lost. Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.	Total.
4	1892. Oct. 26 9.30 a.m.	1	Cramlington -	Northumberland	Cramlington Coal Co., Ld.	Hugh King -	36	Miner -	Inquest attended. The deceased was riding in a set of tubs up an incline, when something gave way, and the tubs moving backwards ran off the rails, and King was found injured in a refuge hole. The coupling shackle had given way, and when afterward examined it was found that the bolt was too small for the hole, and it had been imperfectly riveted. The result was that the riveted part of the bolt had become so small as to be able to pass through the hole in the shackle. If the shackle had been properly examined by the person appointed for the purpose, its condition would have been seen, and there was gross carelessness on his part in omitting to do so, especially as men were in the habit of riding on the set. Died March 17th, 1893.	–	–	–	1	–	1
5	Nov. 28 1.0 p.m.	6	Seghill - -	Ditto -	Joseph Laycock & Co.	Ellis Pearson -	16	Pony putter	Inquest attended. It appears that the boy was driving two tubs down a slight incline, when the pony stumbled and ran against the props, knocking two out, which caused a fall of stone and injuries to Pearson. Died 17th January 1893.	–	1	–	–	–	1

List of Fatal Accidents—*continued.*

No. of Accident.	Date and Hour of the Accident.	Hour of the Person's Shift, *i.e.*, No. of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	No. of Lives lost. Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.	Total.
6	Dec. 27 9.0 a.m.	2	Ashington	Northumberland	Ashington Coal Co.	James Turnbull	16	Putter	Inquest attended. He is said to have been kicked by a pony, but continued for some time at his work. He afterwards became ill, and died on 21st April 1893.	–	–	–	1	–	1
7	Dec. 29 2.0 a.m.	5	Onston "A"	Durham	Charles Perkins & Partner, Ld.	David Dixon	60	Shifter	Inquest attended. The evidence went to show that Dixon was engaged taking up rails or plates, and injured his knee, from which injury he subsequently died, on the 8th April 1893.	–	–	–	1	–	1
1	1893. Jan. 23 10 a.m.	4	St. Helens	Cumberland	St. Helen's Colliery and Brickworks Co., Ld.	Joseph Minnican	25	Hewer	Inspection made and inquest attended. The deceased was working with another man at the face of the coal, when a large piece burst away, and knocked him against the packing, killing him instantly.	–	1	–	–	–	1
2	Jan. 27 11 p.m.	3	Brayton Domain.	Ditto	Joseph Harris	Thomas Richardson.	55	Shifter	Inspection made and inquest attended. It appears that the deceased was engaged cleaning out the sump at the bottom of the shaft, and from some misunderstanding of the signals the engineman owered the cage on to him, causing his death.	–	–	1	–	–	1

List of Fatal Accidents—*continued.*

No. of Accident.	Date and Hour of the Accident.	Hour of the Person's Shift, *i.e.*, No. of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	No. of Lives lost. Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.	Total.
3	Jan. 31 2 p.m.	4	Dipton -	Durham -	John Bowes and Partners, Ld.	James Walker -	25	Hewer -	Inspection made and inquest attended. He was evidently hewing when a flat stone, about 5 in. thick, fell out from between two "backs," one of them close up to the face of the coal. It is doubtful whether he had any props under the stone, but, considering the nature of the roof, and that the face was 5 ft. from the pack, he ought to have had more props set.	–	1	–	–	–	1
4	Feb. 28 3.5 p.m.	7	Wallsend -	Northumberland	Wallsend & Hebburn Coal Co., Ld.	James Stewart -	22	Labourer -	Inspection made and inquest attended. Deceased and other men were engaged at a crab to steady some pumps stocks into the shaft, and without any apparent reason they left the crab, which began to revolve rapidly, but before the deceased could get away he was knocked down, and died from the injuries he received.	–	–	–	–	1	1
5	March 3 2.0 p.m.	7	East Holywell	Ditto -	East Holywell Coal Co., Ld.	Edward Venner -	14	Driver -	Inspection made and inquest attended. A stone fell out from between two baulks, which were 7 ft. apart at the flat. According to the evidence of the deputy, who was at the flat at the time, and of others, no danger had been apprehended. It is possible that the weight had ridden over from a long-wall face not far off, and so disturbed the roof.	–	–	–	–	1	1

List of Fatal Accidents—*continued.*

No. of Accident.	Date and Hour of the Accident.	Hour of the Person's Shift, *i.e.*, No. of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	No. of Lives lost. Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.	Total.
6	March 15 4	10	Cambois -	Northumberland	Cowpen Coal Co., Ld.	Frederick Marshall.	19	Putter -	Inspection made and inquest attended. Contrary to rules, he was riding his pony, and galloping towards the stables when he met the "sett", of tubs, and he was severely crushed. The road is in good order, and with plenty of width.	–	1	–	–	–	1
7	March 16 7.40 a.m.	2	Walbottle -	Ditto -	Walbottle Coal Co. -	G. Simpson -	15	Incline-lad -	Inspection made and inquest attended. This boy was working at the foot of an incline plane, coupling tubs. He was sitting in a safe place when the "sets" started, but on hearing the tubs running back he tried to get into another place opposite, and was caught. A coupling link broke at the welding, causing the full tubs to run against the empty ones, and breaking the rope. The accident was evidently due to defective welding, but it is doubtful whether it could have been detected on examination.	–	–	–	1	–	1

List of Fatal Accidents—*continued.*

No. of Accident.	Date and Hour of the Accident.	Hour of the Person's Shift, *i.e.*, No. of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	No. of Lives lost. Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous. Underground.	Above Ground.	Total.
8	March 17 7.45a.m.	3	Prudhoe -	Northumberland	Mickley Coal Co. -	John Ellison -	21	Putter -	Inquest attended. Deceased was bringing a full tub from the face to the flat, and he was being followed by another putter, who, although having a drag in the wheel, lost control of the tub which ran against the deceased, killing him instantly. It is presumed that, on starting, the drag in the second tub's wheel was not far enough in, and gradually worked out as the tub was in motion.	–	–	–	1	–	1
9	Mar. 17 3.40 p.m.	8	Ashington -	Ditto -	Ashington Coal Co. -	John Smith -	22	Shifter -	Inspection made and inquest attended. The deceased and another man were travelling outbye on what is known as the putter's road, when a sudden fall of stone took place at a part which was considered quite safe, and killed deceased.	–	1	–	–	–	1
10	Mar. 18 11.45p.m.	4	Cramlington -	Ditto -	Cramlington Coal Co., Ld.	John Hicks -	38	Hewer -	Inspection made and inquest attended. He was kirving at a "stook," when a piece of coal fell over from a "back" and caught him. He would have been safer if he had had a sprag set under the coal.	–	1	–	–	–	1

List of Fatal Accidents—*continued.*

No. of Accident.	Date and Hour of the Accident.	Hour of the Person's Shift, i.e., No. of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	No. of Lives lost. Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.	Total.
11	Mar. 25 9.30 a.m.	4	St. Helens -	Cumberland -	St. Helen's Colliery and Brick Works Co., Ld.	Henry T. Rogers	23	Hewer -	Inspection made and inquest attended. Deceased, with other men, was working at the coal face near the goaf, when a lump of coal fell and killed him instantly. This accident might not have happened if sprags, or short props, had been used to support the undercut coal, but it appears the men did not consider it necessary to use them.	–	1	–	–	–	1
12	Mar. 27 3 p.m.	6	Walker -	Northumberland	Walker Coal Co. -	Charles Griffiths	45	Ditto -	Inquest attended. He died on the 21st September, and from the evidence given at the inquest he appears to have strained himself whilst lifting a stone.	–	–	–	1	–	1
13	Mar. 30 6 30 a.m.	1	North Biddick	Durham - -	Sir George Elliot, Bart.	John Morgan -	18	Putter -	Inspection made and inquest attended. Three tubs out of a "set" got off the road when coming round a curve, knocking out a prop and severely injuring the deceased, who was in a refuge hole. He died on 8th April.	–	–	–	1	–	1

List of Fatal Accidents—*continued.*

No. of Accident.	Date and Hour of the Accident.	Hour of the Person's Shift, *i.e.*, No. of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	No. of Lives lost. Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.	Total.
14	April 1 12.45p.m.	5	Throckley	Northumberland	Throckley Coal Co., Ld.	Geo. Hindmarsh	45	Hewer	Inspection made and inquest attended. He had allowed the right-hand side of the place to get too far behind, and put in a shot which was overcharged and in the fast, to blow out the coal in the corner in order that he might get down the band easier. Immediately the shot went off, and without waiting for the smoke to clear, he went into the place, and the band, shaken by the shot, came away from between two "slips" on to him.	–	1	–	–	–	1
15	April 14 2 p.m.	4	Walbottle	Ditto	Walbottle Coal Co.	James Carr	23	Ditto	Inquest attended. He was bending down kirving or picking some dirt from the coal, when a small piece of band fell on the back of his head, forcing his mouth on to his knee, which was cut, and knocking two teeth out. He died on the 18th May, from blood poisoning.	–	1	–	–	–	1
16	May 1 12.35p.m.	3	Bedlington (Doctor).	Ditto	Bedlington Coal Co., Ld.	George Price	19	Ditto	Inspection made and inquest attended. He had kirved a jud and taken out a "tack" or coal sprag at the loose end. On again commencing to kirve, the coal fell on to him from a straight face and slippery "back."	–	1	–	–	–	1

List of Fatal Accidents—*continued.*

No. of Accident.	Date and Hour of the Accident.	Hour of the Person's Shift, *i.e.*, No. of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	No. of Lives lost. Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.	Total.
17	May 3 12 p.m.	7	Whitehaven (Croft).	Cumberland -	Whitehaven Colliery Co.	Thos. Harrison -	44	Contractor -	Inspection made and inquest attended. The deceased was engaged making a new travelling road through some old workings. Instead of taking a large stone down he attempted to set props under it to support it, and when doing so the stone fell on him.	–	1	–	–	–	1
18	May 8 5.30 p.m.	3	Walker -	Northumberland	Walker Coal Co., Ld.	James Irving -	37	Stoneman -	Inspection made and inquest attended. After drilling a hole in the top canch on a waggon way and knocking out some props, he foolishly went under the stone to knock more props out, when a fall took place, killing him. He could easily have knocked the props out without going under the canch.	–	1	–	–	–	1
19	May 12 12.30p.m.	6	St. Helens -	Cumberland -	St. Helens Colliery and Brick Works Co., Ld.	Isaac Owens -	17	Driver -	Inspection made and inquest attended. He was driving, when a full tub got off the rails, and, when lifting it on again, he sprained himself, in a few days becoming seriously ill, and dying within a week.	–	–	–	1	–	1

List of Fatal Accidents—*continued.*

No. of Accident.	Date and Hour of the Accident.	Hour of the Person's Shift, i.e., No. of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	No. of Lives lost. Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.	Total.
20	May 13 4 p.m.	2	Seaton Delaval	Northumberland	Seaton Delaval Coal Co.	William Palmer -	44	Chargeman	Inspection made and inquest attended. The deceased was working in a long-wall gateway, and foolishly went under the canch after the timber had been drawn, when the stone fell without warning from a loose end at one side and a "back" at the other. A shot-hole had been drilled, and was ready for charging.	–	1	–	–	–	1
21	May 18 11.30 a.m.	5	St. Hilda -	Durham - -	Harton Coal Co., Ld.	Thomas Smith -	17	Staple boy -	Inspection made and inquest attended. The deceased, who was engaged at the bottom of a staple as assistant hooker, was caught by the cage, carried to the top, and crushed to death. His duties were simply to lift the slot on the empty side, so that the empty tubs could run out. Beyond that he had nothing whatever to do with the cage, and why he should have been near the cage at the time it is impossible to say.	–	–	1	–	–	1
22	May 24 10.0 p.m.	5	Dunston -	Ditto -	John Bowes & Partners, Ld.	Robert Lowens - George Fulthorpe	32 19	Shifter - Putter.	Inspection made and inquest attended. Explosion of fire-damp.	2	–	–	–	–	2

List of Fatal Accidents—*continued.*

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23	May 26 4.0 p.m.	6	Coanwood	Northumberland	Coanwood Coal Co.	Thomas Scott	22	Hewer	Inspection made and inquest attended. Deceased was hewing, and in doing so exposed a "back" which ran up into the roof, when the stone suddenly came away to a feather edge, and breaking a plank under it. The deputy was in the place at the time, but did not intend to set any more timber.	–	1	–	–	–	1
24	May 29 10.0 p.m.	6	South Derwent	Durham	Owners of South Derwent Colliery.	Joseph Hall	30	Chock-drawer.	Inspection made and inquest attended. He was engaged drawing out timber, and after drawing all the chocks but three, he foolishly went in to draw a prop, when the place came in.	–	1	–	–	–	1
25	June 2 2.20 a.m.	8	Walker	Northumberland	Walker Coal Co., Ld.	John McKie	16	Assistant onsetter.	Inspection made and inquest attended. In lowering full tubs into a three-decked cage, he neglected to put the chock in for the last two, and whilst he and the onsetter were trying to stop the tubs, he (deceased) was in some way drawn into the shaft, and fell a distance of 42 fathoms.	–	–	1	–	..	1

List of Fatal Accidents—*continued.*

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26	June 5 6.0 a.m.	1	South Medomsley.	Durham	South Medomsley Colliery Co.	John Wears	28	Hewer	Inspection made and inquest attended. The deputy on examining the place previous to the deceased commencing work, saw that the clay above the coal was not safe, and went in with the deceased and told him how to take it down. Deceased appears to have been working in the coal instead of obeying the deputy's instructions, as he was found buried under the clay.	–	1	–	–	–	1
27	June 15 11.30p.m.	8	Usworth	Ditto	John Bowes & Partners, Ld.	Samuel Ward	52	Stoneman	Inspection made and inquest attended. Several men were coming out-bye on the engine plane, and hearing the "set" approaching, went into refuge holes. As the set was passing, some of the tubs got off the way, and crushed deceased, who was looking out of the refuge hole, about the body, and he afterwards died from the injuries.	–	–	–	1	–	1
28	June 16 9.30 a.m.	7	Cramlington	Northumberland	Cramlington Coal Co., Ld.	Thomas Turnbull	58	Hewer	Inspection made and inquest attended. A piece of stone had fallen in a gateway from "jacks," cutting the deceased's head, and knocking him out of the way, and from the appearance of the body it is supposed that he bled to death before anyone found him.	–	1	–	–	–	1

List of Fatal Accidents—*continued.*

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29	June 21 8.0 a.m.	2	South Tanfield	Durham -	James Joicey & Co., Ld.	James McKie -	18	Driver -	Inquest attended. When riding on the limmers, the deceased's pony fell, and deceased's leg was severely crushed between the tub and the limmers. The road being on an incline, he should not have been riding on limmers.	–	–	–	1	–	1
30	June 23 6.15 p.m.	5	Allhallows -	Cumberland -	Allerdale Coal Co., Ld.	William Lawman	24	Hewer -	Inspection made and inquest attended. While the deceased was working at the coal, a large stone fell from between "slips" on one side, and a fracture near the face on the other side, on to him. The place was examined and reported safe by the deputy only a few minutes before the accident happened.	–	1	–	–	–	1
31	June 28 5.30 a.m.	3	Allerdale (William).	Ditto -	Ditto - -	George Graham	27	Ditto -	Inspection made and inquest attended. After firing a shot in the roof, the deceased began dressing the loose stone, when a large stone fell on to him. An examination showed that the stone had fallen from between "slips," which were not noticed until after the fall.	–	1	–	–	–	1

List of Fatal Accidents—*continued.*

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32	July 1 6.30 a.m.	3	Coxlodge -	Northumberland	Burradon and Coxlodge Coal Co., Ld.	John Mole -	52	Onsetter -	Inspection made and inquest attended. This happened at a temporary "inset," where there were no keps. As deceased was crawling over the tub which he had put into the cage, to put the catch, which he had forgotten, right, he must have started the tub, which ran off the cage, standing, as it did, a short distance above the flatsheets, and the back end tipping up, he was caught against the crossbar. Deceased was an experienced onsetter.	–	–	1	–	–	1
33	July 4 8.30 a.m.	4	Ravensworth -	Durham -	Charles Perkins and Partners.	John Sambles -	30	Hewer -	Inspection made and inquest attended. He was taking off the last part of the "lift," when the deputy went into the place, and had pricked through into the waste at one point. The deputy had a prop ready to set, and was waiting whilst the deceased hewed some of the bottom coals to fill his tub, when the stone fell from a slippery fracture, crushing down the coal and canting out a prop, and causing instant death.	–	1	–	–	–	1

List of Fatal Accidents—*continued.*

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34	July 7 9 p.m.	2	Cramlington -	Northumberland	Cramlington Coal Co., Ld.	William Wilson	26	Hewer -	Inspection made and inquest attended. He was working in the "brokens," and after finishing his kirving he "nicked" the jud somewhere about the middle, leaving it standing with two loose ends, when the coal and stone fell on to him. Stays or sprags should should certainly have been used in this case.	–	1	–	–	–	1
35	July 12 1 p.m.	5	Watergate -	Cumberland -	Flimby Colliery Co. -	Edward Mallins	57	Ditto -	Inspection made and inquest attended. Deceased was assisting a putter to lift his full tub on to the rails, when he slipped and fell, and afterwards left the pit complaining of a pain in the chest. He died a few days afterwards from a ruptured lung.	–	–	–	1	–	1
36	July 14 8.30 a.m.	7	Marley Hill -	Durham -	John Bowes and Partners, Ld.	Thomas Bewick	50	Shifter -	Inspection made and inquest attended. Deceased and another man were working near the coal face, and after taking some props out had wedged down some stone and band, when unexpectedly a further fall of stone took place and caught the deceased.	–	1	–	–	–	1
37	July 21 44.5 a.m.	3	Felling -	Ditto -	Ditto - -	Francis Owens -	31	Deputy -	Inspection made. When working through an old headways a fall of stone from slippery "backs" caught him. His marrow was in the act of handing him a prop to set when the stone fell.	–	1	–	–	–	1

List of Fatal Accidents—*continued.*

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38	July 24 10.15a.m.	5	Caroline -	Northumberland	Wm. Benson & Sons	George Sousby -	36	Master-sinker.	Inspection made and inquest attended. He had gone up the pit for a charge of explosive, and was descending again, when by some means he fell from the kibble. According to the evidence he was riding with one leg in and one out of the kibble, and he either fell through carelessness or in consequence of a sudden faintness.	–	–	1	–	–	1
39	July 25 9.55 a.m.	6	Cowpen (Mill)	Ditto - -	Cowpen Coal Co., Ld.	John Taylor -	53	Hewer -	Inspection made and inquest attended. He had gone about 8 feet under the ramble, and had three props and a plank set, and was apparently safe, but a large stone suddenly fell from a slip running diagonally across the place and breaking off at the side, knocking out two of the props which were under the lighter end of the stone. It would have been better if he had got the ramble down.	–	1	–	–	–	1
40	July 26 8.30 p.m.	3	Ouston (A.). -	Durham - -	Charles Perkins and Partners.	Thos. Hindmarsh	50	Winding engineman.	Inspection made and inquest attended. Whilst oiling some parts of the winding engine from the top of the vertical cylinder he appears either to have taken a fit or slipped and fallen from the ladder.	–	–	–	–	1	1

List of Fatal Accidents—*continued.*

No. of Accident.	Date and Hour of the Accident.	Hour of the Person's Shift, *i.e.*, No. of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	No. of Lives lost. Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.	Total.
41	July 31 3.0 p.m.	9	Cramlington -	Northumberland	Cramlington Coal Co., Ld.	James Brewis -	18	Shunter -	Inspection made and inquest attended. Deceased was shunting a waggon of coals, and instead of waiting till he had got past the switch, as he should have done, he loosed off the horse too soon, and in stepping over the switch his foot caught and the waggon ran over him. The deceased was assistant to the shunter, and had no business with the horse, and had just been told by the shunter to leave it alone.	–	–	–	–	1	1
42	July 31 12.30p.m.	7	Wearmouth -	Durham - -	Wearmouth Coal Co., Ld.	Ed. Fletcher -	17	Driver -	Inspection made and inquest attended. It was the deceased's duty to stop the "set" at the top of a bank, put two drags in, and then start again, but it is supposed on this occasion he did not stop the pony, and was running alongside to get on the limmers, when he was caught against a prop which was much nearer to the tubs than the others.	–	–	–	1	–	1
43	Aug. 2 3.30 p.m.	6	Axwell - -	Ditto - -	Hannington & Co., Ld.	George Dodds -	34	Deputy -	Inspection made and inquest attended. Whilst drawing props out of an old bord, contrary to the overman's orders, and without the usual assistance, a fall took place and killed him. The overman was the deceased's brother.	–	1	–	–	–	1

List of Fatal Accidents—*continued.*

No. of Accident.	Date and Hour of the Accident.	Hour of the Person's Shift, *i.e.*, No. of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	No. of Lives lost. Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.	Total.
44	Aug. 16 10.30a.m.	4	Mickley -	Northumberland	Mickley Coal Co. -	Wm. Glaister -	15	Driver -	Inquiries made. He was found dead on the road in front of some tubs. It transpired after the accident that the deceased had been unwell on the previous day and had fallen off the "set," and it is supposed that he had had a fit on the day in question.	–	–	–	1	–	1
45	Aug. 18 2.20 a.m.	9	Whitburn -	Durham - -	Harton Coal Co., Ld.	Ed. Liddle -	32	Deputy -	Inspection made. Deceased and another deputy were drawing timber, and had almost finished when a heavy fall took place and caught deceased. This is one of the usual sort of avoidable accidents to deputies when drawing juds. The prop he was engaged with should apparently have been drawn at an earlier stage.	–	1	–	–	–	1
46	Aug. 23 10.20a.m.	5	Asby - -	Cumberland -	Asby Colliery Co., Ld.	Thomas Milling	67	Ditto -	Inquest attended. The roof near the working face being bad, a centre prop was set, which afterwards had to be taken out, and it was whilst the deceased was preparing to do this that a fall of stone took place from several "slips" and caught him.	–	1	–	–	–	1

List of Fatal Accidents—*continued.*

No. of Accident.	Date and Hour of the Accident.	Hour of the Person's Shift, *i.e.*, No. of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	No. of Lives lost. Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.	Total.
47	Sept. 2 10.15a.m.	1	West Shield Row.	Durham - -	Owners of South Derwent Colliery.	James Hogg -	32	Sinker -	Inspection made. Deceased and others were engaged shooting stone down at shaft bottom, preparing for an archway. A shot had been fired, and soon after some stone, shaken by the shot, fell and crushed deceased. The men evidently had not sufficient timber set, but it was said that some had been blown out by the shot, and they had not had time to replace it.	–	1	–	–	–	1
48	Sept. 8 12.30a.m.	6	Hebburn -	Ditto - -	Wallsend & Hebburn Coal Co., Ld.	James Brown -	–	Putter -	Inquiries made. It is said that the deceased was crushed in the pit, but continued at work for a day or so. He afterwards died from typhoid fever, accelerated by the accident.	–	–	–	1	–	1
49	Sept. 12 8.35 a.m.	8	Felling -	Durham - -	John Bowes and Partners, Ld.	William Bullock	51	Horse-shoer	Inspection made. The deceased, on ascending the shaft, appears to have been in too great a hurry to get out of the top deck of a five-decked cage, and in some way was crushed between the cage and the shaft framework.	–	–	1	–	–	1
50	Sept. 15 2.30 a.m.	8	Ashington -	Northumberland	Ashington Coal Co. -	Thomas Robinson	20	Putter -	Inspection made and inquest attended. Deceased, in rolling an empty tub over to one side to allow some full ones to pass, knocked out a prop and a plank, causing a fall of stone, which killed him.	–	1	–	–	–	1

List of Fatal Accidents—*continued.*

No. of Accident.	Date and Hour of the Accident.	Hour of the Person's Shift, i.e., No. of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	No. of Lives lost. Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.	Total.
51	Sept. 16 3.30 p.m.	3	South Tanfield	Durham - -	James Joicey and Co., Ld.	Joseph Strong -	55	Shifter -	Inquiries made. Deceased was injured on the hip by a piece of ramble falling when he was sitting between two props. Died on 8th October.	–	1	–	–	–	1
52	Sept. 18 3 p.m.	6	Felling -	Ditto -	John Bowes and Partners, Ld.	Peter Barrett -	39	Hewer -	Inspection made. Whilst at work a large stone fell from a slippery parting in the roof, breaking down some timber and killing the deceased.	–	1	–	–	–	1
53	Sept. 20 3 p.m.	3	Bedlington (A.)	Northumberland	Bedlington Coal Co., Ld.	John R. Joice -	30	Ditto -	Inquest attended. A man who was working with the deceased stated that he (deceased) was kirving in the coal, when a stone fell from between a small fault and a "slip" on to him, causing injuries from which he died on 28th October. He considered the place safe.	–	1	–	–	–	1
54	Sept. 22 6.50 a.m.	1	Ashington -	Ditto -	Ashington Coal Co. -	John Dunn -	13	Token lad -	Inspection made and inquest attended. Deceased had neglected to take out the token from a tub, and in attempting, unperceived by the bankman, to get it when the tub was in the cage, was caught as the cage moved away.	–	–	–	–	1	1

List of Fatal Accidents—*continued.*

No. of Accident.	Date and Hour of the Accident.	Hour of the Person's Shift, i.e., No. of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	No. of Lives lost. Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.	Total.
55	Sept. 29 4 p.m.	10	Usworth -	Durham - -	John Bowes and Partners, Ld.	Thomas W. McWherter.	19	Putter -	Inspection made and inquest attended. The deceased was leaving his work, and when he got near the shaft he found the "set" standing. He stood until it moved, when part of the "set" ran backwards, and he was crushed against the side of an arch. The accident was due to the landing lad insecurely connecting the coupling chain with the tubs.	–	–	–	1	–	1
56	Oct. 2 6.30 a.m.	1	South Derwent	Ditto - -	Owners of South Derwent Colliery.	Timothy Scott -	40	Onsetter -	Inspection made. Deceased was leaning over the gate at an inset, talking to another onsetter at a seam below, when the descending cage caught his head. There is a proper and safe place for the onsetter to speak to the one below, if necessary.	–	–	1	–	–	1
57	Oct. 9 12.15p.m.	2	Beamish (Air)	Ditto -	James Joicey and Co., Ld.	William Charlton	30	Deputy -	Inspection made. He was drawing timber out of an old working place, when one of the props sprang out and struck him on the back of the head. Had he used a "punch" or chain and lever instead of his axe, he would have got out of the way.	–	–	–	1	–	1

List of Fatal Accidents—*continued.*

No. of Accident.	Date and Hour of the Accident.	Hour of the Person's Shift, i.e., No. of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	No. of Lives lost. Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.	Total.
58	Oct. 9 11 a.m.	6	Whitburn -	Durham -	Harton Coal Co., Ld.	Patrick Crawley	27	Hewer -	Inspection made and inquest attended. He was kirving in the bottom coal, and the band above fell on him. He had been told to set sprags, but neglected to do so.	–	1	–	–	–	1
59	Oct. 9 5.30 p.m.	7	Washington -	Ditto -	Washington Colliery Co.	John Blackburn	50	Stoneman -	Inspection made and inquest attended. After firing a shot in a stone drift, deceased began kirving again without previously examining the roof, and some stone which had been loosened by the shot fell on to him, crushing him so severely that he died.	–	1	–	–	–	1
60	Oct. 12 3 p.m.	6	Burradon -	Northumberland	Burradon and Coxlodge Coal Co., Ld.	Peter Battle	25	Hewer -	Inspection made and inquest attended. Deceased was at the place, some distance from the face, where he and other men kept their clothes, when a stone suddenly fell from between some "jacks" on to him.	–	1	–	–	–	1
61	Oct. 16 9 a.m.	6	Ditto -	Ditto -	Ditto - -	Geo. Henry Harle	30	Ditto -	Inspection made and inquest attended. When working in a longwall face, the deceased was crushed by a fall of stone, which came from between "jacks" and a slippery top parting. It would have been better if the props had been set closer up to the coal.	–	1	–	–	–	1

List of Fatal Accidents—*continued.*

No. of Accident.	Date and Hour of the Accident.	Hour of the Person's Shift, *i.e.*, No. of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	No. of Lives lost. Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.	Total.
62	Oct. 23 9.30 a.m.	5	Cramlington -	Northumberland	Cramlington Coal Co., Ld.	Matthew Rid y	22	Screener -	Inspection made and inquest attended. Deceased was working between two waggons, which were standing, and some other waggons, over which a man had lost control, ran into them and crushed deceased. The waggons which were in motion had the brakes applied and drags in the wheels, but they did not have much effect on the wet and greasy rails. It was not known that the deceased was working at this particular place.	-	–	–	–	1	1
63	Oct. 28 10.0 a.m.	1	Walbottle -	Ditto -	Walbottle Coal Co. -	Joseph Lowrison	47	Back over-man.	Inquest attended. This was a simple accident. The full tubs were standing on the crossing, and deceased was pulling them out of the way of the empty tubs, when his foot slipped, and he fell against the pony, which was startled, and dragged two of the empties over the deceased.	–	–	–	1	–	1
64	Nov. 1 11.0 a.m.	1	Ditto. -	Ditto -	Ditto - -	Robert Browell -	30	Hewer -	Inspection made and inquest attended. Deceased was taking out a pillar in the "brokens," when a fall of stone took place from between a small "fault" and a parting in the roof.	-	1	–	–	–	1

List of Fatal Accidents—*continued.*

No. of Accident.	Date and Hour of the Accident.	Hour of the Person's Shift, *i.e.*, No. of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	No. of Lives lost. Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.	Total.
65	Nov. 9 11.0 a.m.	2	Wardley -	Durham - -	John Bowes and Partners, Ld.	John Mills -	45	Hewer -	Inspection made and inquest attended. Deceased was working in the "brokens," when a stone fell on to him from "slips" in the roof which could not be detected. The roof appeared to be well supported by props.	–	1	–	–	–	1
66	Nov. 12 7.0 a.m.	1	Seaton Burn -	Northumberland	Ditto - -	Robert Aitchison	43	Master shifter.	Inquest attended. He had been examining the workings of the mine, and was found dead on the rolley way. There were marks on deceased's ear and neck, as if he had fallen over something.	–	–	–	1	–	1
67	Nov. 17 11.30p.m.	5	Burnopfield -	Durham - -	Ditto - -	Daniel Porter -	20	Hewer -	Inquest attended. Deceased was engaged taking down top coal when a fall of stone occurred, knocking or canting out some props, and crushing him. The stone had been examined shortly before the accident, and considered safe and properly timbered.	–	1	–	–	–	1
68	Nov. 20 2.45 p.m.	6	North Elswick	Northumberland	Elswick Coal Co., Ld.	Mark Bell -	23	Ditto -	Inspection made and inquest attended. Deceased was taking off coal at the side of the way to make width for a landing, and in doing so was under an overhanging stone, which fell on to him. This stone ought to have been taken down before commencing work.	–	1	–	–	–	1

List of Fatal Accidents—*continued.*

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										Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.	Total.
69	Nov. 20 11.30a.m.	5	Claravale -	Durham - -	Stalla Coal Co. -	John Robert Waugh.	16	Assistant waiter-on.	Inspection made and inquest attended. In shoving a tub on to a bogie running over the shaft, the deceased appears to have sent it with such force as to knock the chock (placed there to stop the tub) out, when the tub went into the shaft, dragging the deceased after it.	–	–	1	–	–	1
70	Nov. 23 8.30 a.m.	2	Ashington -	Northumberland	Ashington Coal Co. -	John Thomas Bell.	17	Putter -	Inquest attended. It was said that the deceased was injured by some planks falling on him which had been knocked out by the pony. The case does not seem to have been reported to any of the officials at the time, and the deceased continued at his work for a few days, when he was taken ill, and died on the 6th December.	–	–	–	1	–	1
71	Nov. 25 2.0 p.m.	8	Flimby - -	Cumberland -	Flimby Colliery Co. -	Daniel McGee -	60	Hewer -	Inspection made and inquest attended. Deceased and others were leaving their working places for the day, and came to a place where some timber had been accidentally knocked out. Men were there repairing the road, and warned deceased and others not to pass. Deceased appears to have made a rush to get past the place, when a fall of stone caught him.	–	1	–	–	–	1

List of Fatal Accidents—*continued.*

No. of Accident.	Date and Hour of the Accident.	Hour of the Person's Shift, *i.e.*, No. of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	No. of Lives lost. Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.	Total.
72	Dec. 1 9.0 p.m.	3	Newburgh -	Northumberland	Radcliffe Coal Co., Ld.	James Mitchell -	39	Deputy -	Inspection made and inquest attended. The deceased and another man were engaged in building two scaffolds on either side of the pit for the purpose of opening out the "Queen" seam. The other man had laid and nailed down six planks whilst the deceased had laid down five planks, two only of which were nailed. He then sent the cage away to bank for two other men, and immediately after slipped and fell down the pit.	–	–	1	–	–	1
73	Dec. 13 2.30 a.m.	10	Ravensworth -	Durham - -	Chas. Perkins & Partners, Ld.	Matthew Blacklock.	60	Wasteman -	Inspection made. He was ridding an old headways, and, after crossing a bord, he had set up two planks with props under one end, and was clearing the ground for the props under the other ends when a stone fell from over the corner of the pillar. He had attempted to get this stone down, but failed to do so.	–	1	–	–	–	1
74	Dec. 15 2.30 p.m.	6	Seghill - -	Northumberland	Joseph Laycock & Co.	Joseph Brown -	47	Hewer -	Inquest attended. Whilst at work a small piece of stone fell and injured his knee, and being a weakly man, and the wound having been neglected, blood-poisoning set in, from which he died.	–	1	–	–	–	1

List of Fatal Accidents—*continued.*

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75	Dec. 15 7.0 p.m.	10	Whitehaven -	Cumberland -	Whitehaven Colliery Co.	Henry Haigh -	29	Hewer -	Inspection made and inquest attended. Deceased was travelling on an engine plane towards the shaft, when an empty "set" got detached from the rope, and whilst attempting to get into a refuge hole the deceased was caught and run over.	–	–	–	1	1	1
76	Dec. 19 11.10p.m.	5	Heddon -	Northumberland	Heddon Coal and Firebrick Co.	James Jameson -	26	Shifter -	Inspection made and inquest attended. The deceased and another man were making a place ready for the hewers, when, without any warning, a stone fell from the roof. The place was considered safe by officials who had been in shortly before the accident happened.	–	1	–	–	–	1
77	Dec. 26 7.0 a.m.	3	Washington -	Durham - -	Washington Colliery Co.	Wm. Henderson	32	Hewer -	Inspection made and inquest attended. Fall of stone. He was starting in with a new lift, and after working a short time bared a "slip" in the roof, which brought down the stone, capping two props.	–	1	–	–	–	1

List of Fatal Accidents—*continued.*

No. of Accident.	Date and Hour of the Accident.	Hour of the Person's Shift, *i.e.*, No. of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	No. of Lives lost. Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.	Total.
78	Dec. 28 2.0 a.m.	3	Whitburn -	Durham -	Harton Coal Co., Ld. -	Daniel Burn -	61	Shifter -	Inquest attended. A fall of stone had taken place on a road near a working face. Deceased and another man were sent to put the road right, and when they were doing this a break in the roof was heard, the other man ran out-over, but the deceased ran in an opposite direction for a few yards to get his lamp, when the stone fell on him.	–	1	–	–	–	1

METALLIFEROUS MINES REGULATION ACT, 1872.

FATAL ACCIDENTS, and LOSS OF LIFE arising therefrom, in the NEWCASTLE DISTRICT, 1893.

No. of Accident.	Date and Hour of the Accident.	Hour of the Person's Shift, *i.e.*, No. of Hours he had been at work when the Accident happened to him.	Name of the Mine.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	No. of Lives lost. Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.	Total.
1	Jan. 3 11.0 a.m.	5	No. 5 Pit	Firzington	Fletchers High House Mining Co.	Patrick Doyle	21	Miner's labourer.	Inspection made. Fall of stone from a slip in the roof.	–	1	–	–	–	1
2	Jan. 10 1.45 p.m.	8	No. 1 Pit	Dalton	Millom and Askam Iron Co., Ld.	Herbert T. Holmes.	28	Miner	Inspection made and inquest attended. He fell off the cage and down the shaft. This accident was caused by the gross carelessness of the engine-man, who lifted the cage before he received the signal to do so.	–	–	1	–	–	1
3	Feb. 23 10.30 a.m.	5	No. 2 Pit	Stank	Barrow Hematite Steel Co., Ld.	Sydney Haines	44	Ditto	Inspection made and inquest attended. This man lost his life through his own carelessness. A company of men were engaged blasting rock some distance above the drift where the deceased was working. He and his mate were warned that a shot was about to be fired, but instead of retiring to a place of safety, they took no notice of the warning, and continued to work. On the shot exploding, the rock fell upon the timbers in their working places, knocking them out, killing deceased.	–	1	–	–	–	1

List of Fatal Accidents—*continued.*

No. of Accident.	Date and Hour of the Accident.	Hour of the Person's Shift, *i.e.*, No. of Hours he had been at work when the Accident happened to him.	Name of the Mine.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	No. of Lives lost. Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.	Total.
4	May 1 8.0 a.m.	2	No. 9 Pit -	Stank -	Barrow Hematite Steel Co., Ld.	James Henry Campion.	14	Ore picker	Inspection made and inquest attended. This boy lost his life through his own fault, when attempting to move a railway waggon with which he had no right to interfere. By some means his leg got under the wheel, and he received injuries from which he died on the 4th inst.	–	–	–	–	1	1
5	June 2 2.0 p.m.	8	No. 4 Pit -	Elliscales -	Elliscales Mining Co., Ld.	James Midwood	42	Blacksmith	Inspection made and inquest attended. Deceased and another man were standing on the cage repairing signal wires at the top of the shaft; they gave a signal to lower, but, for some unexplained reason, the engineman raised the cage and the deceased was crushed against the headgear.	–	–	1	–	–	1
6	July 6 12.30a.m.	3	No. 7 Pit -	Stank -	Barrow Hematite Steel Co., Ld.	Alfred King -	28	Miner -	Inspection made and inquest attended. Fall of rock. Some pieces of rock fell from the roof and sides of the working place on to the deceased, causing injuries which terminated fatally in a few minutes. It was elicited at the inquest that no examination had been made by any official either during this or the preceding shift. Had this been done, the accident might have been averted.	–	1	–	–	–	1
7	July 10 8.30 a.m.	3	No. 5 Pit -	Millom -	Hodburrow Mining Co., Ld.	John Fitzwilliam	62	Ditto -	Inspection made. Deceased had lighted the fuse of a shot, and thinking it had mis-fired, returned to the place, when it exploded and killed him.	–	–	–	1	–	1

List of Fatal Accidents—*continued.*

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										Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.	Total.
8	July 18 8.30 a.m.	3	Crossgates -	Dalton -	Harrison, Ainslie, & Co.	Frederick Borwick.	17	Locomotive stoker.	Inspection made and inquest attended. When the locomotive and a waggon were crossing the points, the waggon got off the rails, and crushed the deceased (who was holding the lever) against a gate-post.	–	–	–	–	1	1
9	Aug. 25 9.0 a.m.	3	No. 3 Pit -	Cleator Mo	Crossfield Iron Ore Co.	John Richardson	18	Miner's labourer.	Inspection made and inquest attended. A heavy fall from the roof and sides of an old drift of some stone which had evidently been loosened by a shot previously fired to bring down the adjoining portion.	–	1	–	–	–	1
10	Oct. 9 11.45a.m.	6	North Stank -	Stank - -	Barrow Hematite Steel Co., Ld.	Thomas Nankervis.	48	Miner -	Inspection made, and inquest attended. Deceased and another man were engaged sending up rails from an "inset" in the shaft, and when they were being unloaded at the top one of them, unseen by the banksmen, fell down the shaft, striking a beam in its descent, when a piece broke off, and, falling into the "inset," struck the deceased.	–	–	1	–	–	1
11	Nov. 19 12.30p.m.	4	Croft Pit -	Bigrigg	Lord Leconfield -	William Jenkinson.	39	Joiner -	Inspection made and inquest attended. Deceased and another man were working on a cradle in the shaft, when the crab rope, which was made of hemp, and unfit for use, broke, and deceased fell to the bottom, a distance of about 36 fathoms. (*See* Report.)	–	–	1	–	–	1

List of Fatal Accidents—*continued*.

No. of Accident.	Date and Hour of the Accident.	Hour of the Person's Shift, *i.e.*, No. of Hours he had been at work when the Accident happened to him.	Name of the Mine.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	No. of Lives lost. Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.	Total.
12	Dec. 27 4.0 p.m.	10	No. 3 Pit -	Frizington -	Mowbray Iron Ore Co., Ld.	Benjamin Connor	22	Miner -	Inspection made and inquest attended. He had lighted two shots, only one of which exploded, and on returning to his place he omittted to examine the state of the roof, when a sudden fall of stone took place, killing him on the spot.	–	1	–	–	–	1

Reports of Assistant Inspectors.

---

10 Rosebank, Whitehaven,
19th February 1894.

Sir,

I have the honour to report, in pursuance of section 20 of the Metalliferous Mines Regulation Act, 1872, that during the past year I exercised the duty of Inspector of Mines in the Newcastle-on-Tyne district; and that in doing so I acted under the directions of Mr. J. L. Hedley, the Inspector in charge of the district. I also acted as an Inspector of Mines under the Coal Mines Act, 1887.

I have, &c.,
R. P. W. OSWALD.

The Right Hon. H. H. Asquith, Q.C., M.P.,
Her Majesty's Principal Secretary of State,
Home Department, Whitehall.

---

30 Eldon Street, Newcastle-on-Tyne,
1st March 1894.

Sir,

I have the honour to report, in pursuance of section 20 of the Metalliferous Mines Regulation Act, 1872, that during the past year I exercised the duties of Inspector of Mines in the Newcastle district, and that in doing so I acted under the directions of the Inspector in charge of the district, Mr. John L. Hedley. I also acted as an Inspector of Mines under the Coal Mines Act, 1887.

I have, &c.,
G. F. BELL.

The Right Hon. H. H. Asquith, Q.C., M.P.,
Her Majesty's Principal Secretary of State,
Home Office, Whitehall, S.W.

REPORT

OF

W. N. ATKINSON, Esq., H.M. INSPECTOR OF MINES

FOR THE

NORTH STAFFORDSHIRE DISTRICT (No. 10),

TO

HER MAJESTY'S SECRETARY OF STATE,

UNDER

**The Coal Mines Regulation Act, 1887,
the Metalliferous Mines Regulation Acts, 1872 and 1875,
and the Slate Mines (Gunpowder) Act, 1882;**

For the Year 1893.

Presented to both Houses of Parliament by Command of Her Majesty.

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Mr. Atkinson's Report.

REPORT of the INSPECTOR OF MINES for the DISTRICT comprising NORTH STAFFORDSHIRE, CHESHIRE, and SHROPSHIRE, for the Year ending 31st December 1893.

Newcastle, Staffordshire,
12th March 1894.

SIR,

As required by section 43 of the Coal Mines Regulation Act, 1887, and section 20 of the Metalliferous Mines Regulation Act, 1872, I have the honour to submit the following report on the inspection of mines in the North Stafford Inspection District during the year 1893.

The district comprises the counties of Cheshire and Shropshire, and the northern part of the county of Stafford. A list of the mines, mine owners, managers, &c. of the district, together with those of the other inspection districts is published in a separate volume.

PART I.—MINES UNDER THE COAL MINES REGULATION ACT.

There was no accident of unusual gravity during the year 1893, but there was an increase in the number of lives lost over the preceding year, chiefly due to surface accidents. Owing to a re-arrangement of the summaries of the statistical portion of the reports of the inspectors of mines, by a departmental committee, accidents which occurred on private branch railways and tramways, &c. are now for the first time included with the accidents which occurred in and about the mines, and the persons employed on such private railways, &c., are now included with those employed above ground at the mines. Including the accidents on private railways, &c. in both years there was an increase of 8 in the total number of deaths in the district in 1893 over the preceding year, of which increase only one death was due to accidents underground.

The number of persons employed remains practically the same as in the previous year, but there is again a falling off in the output of minerals.

The year under review has been made memorable by the great dispute as to wages in the mining districts controlled by the Miners' Federation of Great Britain, a dispute which caused the bulk of the workmen in those districts to be out of work from the 28th July to the 18th November, in resistance to a demand for a reduction of wages equivalent to $17\frac{3}{4}$ per cent. Fortunately for this district, the stoppage in North Staffordshire and Shropshire was of much shorter duration. In those portions of the district the colliery owners did not give notice for a reduction of wages, but the miners in North Staffordshire and a portion of those in Shropshire gave 14 days' notice to terminate their engagements, and ceased work between the 12th and 19th August. After being idle for from three to four weeks they were allowed to resume work at the old rate of wages on the 11th September. The Cheshire Collieries, adjoining Lancashire, where the reduction of wages was demanded remained idle for 12 weeks or more.

Persons employed and Minerals raised.

Table showing the Persons employed and Minerals raised at the Mines, under the Coal Mines Regulation Act, in the North Stafford Inspection District during the year 1893.

Counties.	Number of Persons employed.			Tons of Minerals raised.						
	Underground. A.	Above ground. B.	Total. A. & B.	Coal.	Fireclay.	Ironstone.	Oil Shale.	Other Minerals. Amount.	Other Minerals. Description.	Total.
Cheshire	2,135	522	2,657	567,042	12,344	—	—	850	Ganister	580,236
Shropshire	2,792	994	3,786	636,628	8,836	54,596	—	370	Pyrites	751,075
								50,645	Red Clay	
Staffordshire, North	14,593	4,401	18,994	4,962,189	18,525	770,607	4,036	260	Mineral Oil	5,755,617
Totals 1893	19,520	5,917*	25,437*	6,165,859	39,705	825,203	4,036	52,125	—	7,086,928
Totals last year, 1892.	19,284	5,187†	24,471†	6,314,205	54,498	1,048,939	4,663	42,864	—	7,465,169

* Including 963 persons employed on private branch railways and tramways and in washing and coking coal on premises adjacent to or belonging to the mines, who in previous years were recorded separately.
† Excluding 1,068 persons employed on private branch railways, &c.

The above figures are compiled from the statutory returns made by the mine owners. Details as to the sex and ages of the persons employed will be found in Table No. 2 of the Summaries.

Compared with the previous year, and including the persons employed on private branch railways, &c. in both years, there is a decrease in the number of persons employed of 102, or less than ½ per cent., and a decrease in the quantity of minerals raised of 378,241 tons, or more than 5 per cent., the decrease of minerals being due to short time worked in the first half of the year, and the stoppage during the wages dispute.

The average output of minerals per person employed *underground* in the district was 363 tons, the corresponding figure for the United Kingdom being 319 tons. For the previous year the figures were 387 tons for this district, and 349 tons for the United Kingdom.

Information respecting the quantity and value of all minerals wrought in mines throughout the country can be obtained from the "Mineral Statistics of the United Kingdom," an annual publication prepared by H.M. Inspectors of Mines.

Accidents.

The total number of accidents reported during the year 1893, which on inquiry proved to be accidents coming within the Coal Mines Act, and including accidents on private branch railways, &c. was 232. Of these, 41 were fatal accidents, causing the deaths of 41 persons, and injuries to 3 persons, and 191 were non-fatal accidents, causing injuries to 197 persons.

Although the majority of the collieries in the district were stopped for about a month, owing to the wages dispute, this did not result in any reduction of the total number of accidents during the year; when work was resumed after the stoppage, there was great pressure to put out as much coal as possible, and this resulted in a considerable increase in the number of accidents during the latter portion of the year.

The following figures afford a comparison of the death rate, &c. in mines under the Coal Mines Regulation Act, in this district and in the United Kingdom, during the year 1893, including the persons employed on private branch railways, &c. and accidents to such persons:—

—	In the North Stafford Inspection District.	In the United Kingdom.
Death rate from accidents per 1,000 persons employed	1·612	1·552
Number of persons employed per fatal accident	620	844
Number of persons employed per life lost	620	644
Tons of minerals wrought per fatal accident	172,852	216,609
Tons of minerals wrought per life lost	172,852	165,318

The death rate per 1,000 persons employed in the North Stafford district does not compare favourably with the same death rate in the United Kingdom; but considering that the natural conditions of many of the North Staffordshire Mines are unusually dangerous, it is to be hoped, rather than expected, that the death rate will often be as low as for the United Kingdom. No fatal accident occurred in Cheshire during the year, and only one in Shropshire.

A list of the fatal accidents is appended to the Report.

The following tables show the number and causes of the accidents, the counties in which they occurred, and the number of persons killed and injured :—

Fatal Accidents.

Counties.	Fatal Accidents.						Deaths.					
	Explosions of Fire-Damp and Coal Dust.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Under-ground.	On the Surface.	Total.	Explosions of Fire-Damp and Coal Dust.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Under-ground.	On the Surface.	Total.
Cheshire - -	—	—	—	—	—	—	—	1	—	—	—	—
Shropshire - -	—	—	1	—	—	1	—	—	1	—	—	1
Staffordshire, North -	1	18	5	7	9	40	1	18	5	7	9	40
Totals 1893 -	1	18	6	7	9	41*	1	18	6	7	9	41*
Total last year, 1892 - -	—	18	2	10	1	31†	—	19	2	10	1	32†

* Including 2 accidents and 2 deaths on private branch railways.
† Excluding 1 accident and 1 death on do.

Non-Fatal Accidents.

Counties.	Non-Fatal Accidents.						No. of Persons injured, including those injured in Accidents fatal to other Persons.					
	Explosions of Fire-Damp and Coal Dust.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Under-ground.	On the Surface.	Total.	Explosions of Fire-Damp and Coal Dust.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Under-ground.	On the Surface.	Total.
Cheshire - -	—	2	—	2	—	4	—	2	—	2	—	4
Shropshire - -	—	18	2	12	6	38	—	19	2	13	6	40
Staffordshire, North -	4	67	7	47	24	149	4	69	7	52	24	156
Totals, 1893 -	4	87	9	61	30	191	4	90	9	67	30	200
Totals last year, 1892 - -	4	80	10	77	27	198	7	91	11	77	30	216

Explosions of Fire-damp and Coal Dust.

There were five explosions or ignitions of fire-damp during the year, resulting in one death and injury to four persons. In the preceding year there were only four non-fatal accidents from this cause.

Date.	Hour.	Colliery.	Where situated.	Seam.	Barometer.*		No. Killed.	No. Injured.
					Height	R. Rising. F. Falling.		
1893. 21 Jan. -	4.0 a.m.	Birchenwood -	Harecastle	Birchenwood -	30·40	Steady	—	1
4 March -	10.0 a.m.	Shelton, No. 3 Racecourse pit	Hanley	Bassey Mine Ironstone.	29·80	"	—	1
12 June -	6.30 a.m.	Chesterton Forge Pits.	Chesterton	Red Mine Ironstone.	29·95	"	—	1
13 Sept. -	10.0 a.m.	Oldfield -	Longton	Yard -	30·00	F	—	1
2 Dec. -	12.45 p.m.	Hem Heath -	Chesterton	Red Mine Ironstone.	30·25	Steady	1	—

* As registered by a self-recording aneroid barometer at Newcastle-under-Lyme, 430 feet above sea-level.

The explosion at Birchenwood Colliery was due to gas, which had accumulated in an up-bank place, from which ventilation had been cut off for six weeks by an accumulation of water. The water was being pumped out, and as soon as the entrance to the up-bank place was cleared the pump attendant went in from curiosity, with a candle, and ignited the gas. Although the pit produced little fire-damp, and was worked with candles, reasonable foresight on the part of the manager might have caused him to expect gas to be met with in this place. This pit is now worked with safety lamps.

The explosion at Shelton No. 3 Racecourse pit was caused by the ignition, by a miner's candle, of a small quantity of fire-damp at the goaf-edge in the Bassey Mine Ironstone. The miner was slightly burned on the hands and arms. Fire-damp had not previously been detected in the locality. Safety lamps have since been introduced.

The explosion at Chesterton Forge pits occurred in the Red Mine Ironstone, in a "breasting" 12 feet wide, driven 17 yards from a level and rising one in three, with a pack built up the middle. The sheet at the bottom of the pack for directing the air into the "breasting" had been pulled down. A miner who had no business in the place went in with a candle and ignited a little gas and was slightly burned. No fire-damp had been seen in the pit previously.

The explosion at Oldfield Colliery was caused by fire-damp ignited by a gob fire, in the Yard Seam, which was being built off at the time. A stopping in course of erection was blown out and one of the workmen was slightly burned, and struck by some of the bricks. The flame did not extend beyond the stopping.

The explosion at Hem Heath Colliery was caused by the ignition of an accumulation of fire-damp by a candle. The fire-damp collected in a place in the Red Mine Ironstone. Seam about three yards wide, driven 11 yards up from a level, and rising about one in three. The place was not being worked, and was not bratticed nor fenced off. W. Blurton, a miner who worked near the place, went into it for some unknown reason, and ignited the fire-damp with his candle. He was severely burned about the head, arms and body, and died 11 days after. Fire-damp had been found in small quantities on a few occasions previously in this seam, but not in this particular place. It was not a place which workmen had to work in or pass, but it was in close proximity to a working place, and should have been examined daily under the Special Rules. The fireman admitted that he had only gone a few yards into the place on the day of the accident, and there his mark was made. The manager had given instructions that the place should be examined as if it had been a working place, but he had not thought it necessary to have it fenced off or bratticed. Blurton was acting contrary to the Special Rules by going into the place. I advised the owners of the colliery that it was their duty to prosecute the fireman for not properly examining the place; they promised to do so, but failed to carry out their promise.

Falls of Roof and Sides.

One hundred and five accidents from falls of roof and sides were reported during the year. By these accidents 18 persons were killed and 90 injured, the corresponding figures for the previous year being 19 killed and 91 injured.

The following table shows the places where the falls of roof and sides occurred :—

Place where Accident occurred.	Number of Accidents.		
	Fatal.	Non-fatal.	Total.
At working faces - - -	14	71	85
On roads, while repairing or enlarging -	3	6	9
Do. while working or passing -	1	10	11
Totals - -	18	87	105

The above table shows that more than 90 per cent. of the accidents from falls of roof and sides occurred at the working faces or during repairs on roads, in which cases the persons killed or injured are almost invariably the persons who set or repair the timber. In this district the colliers are required to set their own timber at the working faces, it being the duty of the firemen and other officials to see that sufficient timber is set, and that the working faces and roads are made and kept safe, for which the mine owners are held responsible by the Act. There has been considerable argument at different times

as to the relative advantages of the system of requiring colliers to set all their own timber, and the "deputy system" of the North of England, where much of the timber at the working faces is set by deputies, who correspond to the firemen of this and other districts. My opinion is in favour of the "deputy system," but this is not based only on the fact that the deputies set timber, because the colliers in this district are quite competent to set their own timber, and generally do it skilfully and well; but their neglect to set it soon enough often leads to accidents, and this neglect can, to a great extent, be prevented by closer supervision. The great advantage of the deputy system in my opinion is, that it ensures a much closer and more frequent supervision by a responsible official. The deputies having certain work in the way of timbering, bratticing, laying rails, &c., in their districts, the result is that the districts are much smaller, and they are able to visit the workmen more frequently than can be done by firemen having large districts under their charge.

Regulations requiring "systematic timbering" having been drawn up by the managers of a few collieries, and I hope to see this practice extended, as it seems likely to reduce the accidents from falls. Regularity and system in the timbering and packing of long-wall workings will not only reduce accidents, but will effect economy.

The following accidents from falls were due to carelessness by firemen, as well as by the victims.

On the 13th February, at Watermills pit, Apedale Colliery, I. Meadon, a collier, aged 41, was instructed by a fireman to draw timber in an old working in the Bullhurst seam. This he proceeded to do with only a pick and a small hammer as tools, and the firemen saw him at work with these tools, and allowed him to continue. After drawing a few posts, Meadon loosened the foot of another post, and retired, as he heard the roof giving way. After waiting a few minutes the movement of the roof ceased, and he returned to get the post, and while he was doing so the roof fell, and broke his thigh. If he had been provided with proper tools (a long-handled mallet or a "ringer and chain") he might have escaped. One of the special rules provides that timber under a heavy roof shall only be got by a ringer and chain or rope; and the fireman was seriously to blame for allowing Meadon to attempt to draw the timber without proper tools.

On the 22nd March, at the Moss pit, Harecastle Colliery, George Whitehurst, was killed at 6.45 a.m. by a fall of coal from the side of a narrow place in the Bullhurst seam. The coal had been partially holed as a "flitching" during the previous shift, and should have been spragged. A night-shift fireman examined the place before Whitehurst began work, but he neither set any sprags, nor told Whitehurst to do so, nor did he report to the day-shift fireman that sprags were required. At the inquest he admitted that sprags, were necessary, and said he thought any practical man would have set sprags before doing any more holing. Whitehurst, however, who was an experienced miner, continued to hole without sprags, until a solid block of coal weighing about 22 cwts. fell on to him. I advised that the fireman should be prosecuted for a breach of the special rules, but as the agent of the colliery company was of opinion that no conviction could be obtained, and said the fireman had discharged his duties satisfactorily for 14 years, I did not press it further.

Shaft Accidents.

There were six fatal and nine non-fatal shaft accidents during the year, compared with two fatal and 10 non-fatal accidents in the preceding year.

The fatal shaft accidents were as follows:—

At Berry Hill Colliery on the 17th February, at 2 a.m., John Bromley Tansley, aged 17, a boiler stoker, was killed by falling down the shaft of the railway pit from an inset at the Bassey Mine. He was accustomed to go to this place about once a shift to attend to a pump. On the occasion of the accident he was asleep in the engine house when summoned by a fireman to go to the pump. He got a lamp and went down in the cage to the inset. He appears to have fallen down the shaft on his return from the pump, after having given the signal to the engineman to draw him up again. The opening at the inset was wide enough to receive both cages, and was fenced by an iron bar close to the shaft, 3 feet from the floor, turning vertically on a bolt through one end of it. The signal was so arranged that it could be used by a person standing in the cage.

There was nothing unusually dangerous about this inset, but it would have been safer if fenced so as to afford access to one cage only, which was all that was necessary. I also think an older man should have been appointed for this work.

At Talk o'th' Hill Colliery on the 19th March James Warren (37), a shaftman, was killed by falling out of the cage. He and another shaftman were going down in the cage to release water from the fan drift, for which purpose they had with them an iron bar 7 feet long. Warren was carrying the bar, and he put the end of it through a hole in the bottom of the cage close behind one of the cage shoes. It is probable that the projecting end of the bar caught against the head of a "dog" securing the iron guides, and jerked Warren out of the cage. He was an experienced man, and should have foreseen the danger of carrying the bar in this way.

At Florence Colliery on the 19th April Joseph Lomas (32), a sinker, was killed by falling from a scaffold in the shaft through a space left open at the side for ventilation. This space was fenced right across by a chain between two of the scaffold hanging chains. Lomas and two other sinkers were going down the shaft in a "bowk," and when they were about a yard above the scaffold Lomas jumped out, and fell either over or under the fence chain. He should not have left the bowk until it rested on the scaffold, for which the other two men were waiting. I advised that two fence chains should be used, but even two chains might not have prevented such an accident.

At Biddulph Valley Colliery on the 3rd July John Moss (26), a sinker, was killed in a sinking pit by a fall of stone from the side of the shaft from a point about 10 yards above where he was engaged with others in walling the shaft. The stone which fell came from under a curb up to which they were walling. At this point the shaft passed through a thin seam of coal underlaid by 3 feet of warrant, and it was a piece of the warrant which fell. Owing to the dip of the strata the warrant was only exposed over about a third of the circumference of the shaft, the remainder being behind the curb and upper walling. The exposed warrant was, in part, secured by posts and slabs. The sides of the shaft had been examined nine hours previously and reported safe. I thought the place from which the stone fell might have appeared safe, and the sinkers said they thought it was safe.

On the 6th September a miner, named John Morris (40), was killed by falling down the shaft of a clay mine, 40 yards deep, near Broseley, in Shropshire, belonging to Messrs. Jones Bros., while descending in "tacklers" or "doubles." This is an antiquated method of ascending and descending shafts in use in many small mines in Shropshire. The "doubles" are chains, the two ends of which are attached to the winding rope, so as to form loops in which the men sit. On the occasion of the accident Morris, instead of getting into the "double" in the ordinary way, only put one foot in the loop, and stood with one arm round the rope. The banksman asked him why he did not get in properly, but he replied "All right, go on." Soon after he begun to descend Morris fell to the bottom of the shaft; he was wearing clogs, and no doubt his foot slipped out of the "double." This is a dangerous practice, and the banksman should not have allowed Morris to go down in that way, which power he has under the Special Rules.

At Bunker's Hill Colliery, on the 29th December, James Finch (52), was killed by falling down a staple pit, 20 yards deep, owing to the breakage of a hemp rope on which he was descending. The rope was a $\frac{3}{4}$ in. "block" rope, and was bought on the 2nd November 1892, and from that time used for eight weeks in sinking the staple. After that the work was discontinued, the rope taken to the surface and stored in the fan engine house, a dry place. The work was resumed the day before the accident. The rope was wound on the drum of a "wind-peg" or jack roll, 12 in. in diameter and passed down the staple over a pulley 10 in. on the trod. On the day of the accident the rope was examined by a fireman before work commenced. He lowered his lamp to the bottom of the staple on the rope. When Finch and his mates came to work, Finch got into the "rider" to go down the staple, and as soon as his weight was on the rope it broke, and he fell to the bottom. The break occurred at the top of the splice for the capping, at the end of the rope. The end of the rope was passed round an iron "eye" and spliced for about 10 in. back, the splicing and 7 in. of the rope beyond, being wrapped with tarred twine. This capping was done by Finch himself, who was a man of considerable experience in such work, and accustomed to look after all the tackle himself. The rope was slightly worn, but appeared to be in safe working condition, the place which broke being covered by the wrapping at the splice. When the rope was examined after the accident it appeared that at the point where it broke, the hemp was softened and partially pulped. A little water had been drawn the previous day, which would wet

the rope, and the place which failed was about where the rope would be bent when drawn up to the pulley. An extra strain might also have been put on this place the previous day when Finch examined the sides of the staple, swinging round with one hand, holding the rope above the wrapping. The weight of a man was the greatest weight the rope had been used to lift, the "kibble" for stones being only 20 in. deep × 10 in. diameter. The accident shows that if any part of a hemp rope is wrapped, that the wrapping should be frequently removed for the purpose of examination, and that the capping should be frequently renewed. A very pliable steel wire rope would probably be more reliable for such work.

The non-fatal shaft accidents were as follows:—

At Shelton Rowhurst, No. 2 pit, on the 13th February, George Allen (17), had his arm broken by it projecting from the cage. The sides of the cages were too open. This is a source of danger to which it is frequently necessary to call attention, and to some extent it is being remedied. At Shelton Rowhurst, No. 2 pit, on the 22nd February, John Abbotts (51), banksman had his hand injured while getting a loaded tub out of the cage. At Apedale Colliery, Sladderhill pumping pit, on the 15th March, Samuel Hall (65), a pumpman, had his ribs fractured by the fall of a pump bucket door, owing to the breakage of a chain to which it was attached. The chain was a fixture in the shaft to hold the bucket door during repairs. The nature of the iron composing the chain was destroyed by the action of the mine water, and it should have been renewed long before it failed. At High Carr Colliery, on the 23rd March, William Lear (22), assistant banksman, had his jaw broken at the pit top by the cage catching the end of a rail and causing it to spring up. Lear had been renewing the rail, and he had not moved the old rail clear of the cage when he signalled to the engineman to lower the cage. At Shelton Rowhurst pit, on the 26th June, John Barcroft (55), pit fettler, was severely injured by falling down a drop staple pit on the cage. The drop staple was 60 yards deep, and on the day of the accident something went wrong with the brake, and the cage, with a full tub in it, refused to leave the top. It was just at the end of the shift, and the brakesman, before leaving, placed a plank under the cage to prevent it running amain, in case it started before the brake was put right. He then reported the matter, and Barcroft and others were sent to put things right. Barcroft was told exactly how the cage was left, and was cautioned both by the under-manager and the brakesman not to get on the top of the cage as it might start away. Notwithstanding this, the first thing Barcroft did was to get on to the cage, in order to get to the brake, and it immediately went away, broke the plank and passed to the bottom with great speed, as there was no brake to control its motion. It was a wonder Barcroft was not killed; he sustained a compound fracture of the right leg, and simple fracture of left ankle. It was found that a key had dropped out of the brake shaft, so that the lever actuating the brake was loose and could not act. At the Granville Pit, Donnington Colliery, on the 25th September, Jabez Pickering (55), a roadman, on arriving at the bottom of the shaft turned the wrong way, and fell into the opposite cage hole, a depth of about five feet. He was not seriously injured. At the Lawn Pits, Old Park Colliery, on the 16th November, James Pickford (60), was injured by falling part way down one of the shafts, which he was engaged in repairing. A crossbar, or carrier, running in the wood guides was in use in No. 1 pit, and this by some means became jammed. A message was sent for the under-manager, and he said the men were to wait until he came, but this they did not do, but Pickford and others went down No. 2 pit to an insett, and so through to No. 1 pit, above where the carrier was stuck. While looking down the shaft from this insett or while attempting to slide down the guides to the carrier, it is uncertain which, he fell down the shaft about 20 yards, into eight or nine yards of water in the bottom. Fortunately, he did not strike the carrier in his descent, and was not hurt otherwise than by a severe shock to the system. At Addeiley Green Colliery, on the 20th November, G. W. Bettany (35), contractor, had his arm injured while descending in the cage. In this case his arm projected through one of the entrances to the cage, and not through a part which might have been enclosed. The number of men allowed to ride on one deck of the cage were a tight fit, and the manager decided to reduce the number. At Ubberley Colliery, on the 14th December, Thomas Matthews (54), pit fettler, was injured at the top of the winding shaft. A new wire rope guide rod was to be fixed, and for this purpose one of the cages was out of the guides and drawn up above the landing plates. Matthews was assisting to place a plank across the top of the shaft, in doing which the cage was shaken, and being out of the guides it had sufficient play to allow the fence gate to slip off its top, and the gate caught Matthews on the head. This danger might have been foreseen, and the fence gate secured.

Miscellaneous Underground Accidents.

From miscellaneous causes underground there were seven fatal and 61 non-fatal accidents, resulting in the death of seven persons and injuries to 61 persons. The figures for the previous year being 10 fatal, and 77 non-fatal accidents. Of the fatal accidents one was by explosives, two were on inclined and engine planes, two were by tubs, one by machinery, and one by sundries.

Explosions of Gunpowder, &c.—One fatal and nine non-fatal accidents. The fatal accident was of a somewhat unusual character; the victim being suffocated by gunpowder smoke, and a youth who was with him had a narrow escape from the same fate. The accident occurred at Hulme Colliery on the 8th May. Elijah Steele (57), a collier was working in a narrow place (9 feet wide) rising 1 in 3 and about 10 yards up from the level, in the hard mine seam 4 ft. 6 in. thick, assisted by a youth named Johnson as loader. At the end of his shift, 3 p.m., Steele fired two shots of gunpowder, together, by means of fuze. One of the shots would probably contain 1½ lbs. of powder, and the other 1 lb. The shots did not blow down the coal they were intended to get. Steele at once went into the place, which was full of smoke, and began to drill another shot hole. He called to Johnson to bring the powder, and Johnson did so, and sat down a few yards behind Steele. Johnson stated that the place was still full of smoke, and he remembered seeing Steele fall, and he then became unconscious himself. The manager was waiting on the surface for the men to come out, and at 3.30 he went down to see why Steele did not come. When he reached the place, about 200 yards from the shaft, Steele was dead and Johnson unconscious, Steele's lamp was burning near his body, Johnson was seriously ill, but recovered. The place was ventilated with 10 inch air pipes, to within 8 feet from the face, and when it was examined after the accident there was a fair amount of ventilation; the furnace then being brisk. On the day of the accident coal was not being drawn, and only four men were at work, and there was no one to attend to the furnace, but the manager stated that he was at the furnace about 3 o'clock, and that it was burning as usual. However that may have been, it was very imprudent of Steele to return so soon, and to remain in a place so charged with powder smoke. The inquiry disclosed considerable laxity in the management and discipline of the pit.

The non-fatal accidents were as follows:—

At Brown Lees Colliery, on the 1st February, Evan Heath (30), collier, was injured by the explosion of a gunpowder shot which he was illegally unramming. At Park House Colliery, on the 6th February, William Sutton (35), and Daniel Sutton (32), colliers, were slightly burned by an explosion of compressed gunpowder while they were charging a shot hole. The powder was ignited by a candle. At the Freehold Pits, Donnington Colliery, on the 6th February, John Ferriday (33), a getter, was slightly injured by a shot of compressed gunpowder fired with fuze. The shot hole had been drilled too small to take the cartridges whole, and they were broken in pieces. After the shot went off Ferriday and the shotman returned to it, and while they were examining the place a second slight explosion occurred, which blew some debris into Ferriday's face. The second explosion was said to have occurred about three minutes after the first. How it was caused could not be ascertained. At Hulme Colliery, on the 27th June, William Edward (25), collier, was injured by unlawfully unramming a shot of compressed gunpowder. At Shelton, No. 5 Racecourse Pit, on the 8th August, Benjamin Ashton (43), and Job Knight (40), crutters, were injured by the explosion of a shot of compressed powder. No one knew how the accident occurred except the injured men, and they said the powder exploded while they were inserting the second bobbin of powder, which was too large for the shot hole, with a wood stemmer shod with copper. The hole was in warrant and was wet. It was suspected that they had been unramming the shot, but this could not be proved. At Donnington, Grange Pit, on the 20th September, William Plant (40), fireman, and James Ball (40), repairer, were injured by the premature explosion of a shot of compressed gunpowder, primed with a detonator for electrical firing. The explosion occurred while the first of the stemming was being put in with a copper stemmer. It is probable that the detonator had been drawn out of the cartridge during insertion in the hole and exploded by a blow of the stemmer. At Tuckies Pit (Broseley) on the 6th October, John Watson (26), miner, was injured by the explosion of a shot of compressed gunpowder fired by fuze, when he returned to it, thinking it had missed fire. Watson said he waited 20 minutes for the shot to go off, but that may be doubted. The Special Rules require an interval of at least half an hour,

At Getchfield level, on the 18th November, Richard France (39), miner, was injured by the explosion of a shot of compressed gunpowder fired by fuze, to which he returned before it had exploded. He was deceived by hearing another shot go off, which he thought to be his. At Brownhill's Colliery, on the 2nd December, Richard Morris (46), collier, was struck on the arm by a piece of stone blown 38 yards from a shot of compressed gunpowder. The shot was at the face of a slant dip, and Morris went into the level, where he thought he was out of the line of the shot, without being so. His arm had to be amputated.

On Inclined and Engine Planes.—Two fatal and 16 non-fatal accidents. One of the fatal accidents occurred on the 11th February at Clough Hall Colliery, No. 6 pit, belonging to the Birchenwood Colliery Company, Limited, by the breakage of an underground haulage rope, on a steep engine dip. For some time previously this colliery had been in the hands of an official liquidator, and had been carried on without the expenditure necessary to keep the plant and appliances in safe working order. The Birchenwood Colliery Company, Limited, took possession of the colliery as a going concern nine days before the accident. The rope which broke was known to all concerned to be in a bad state, and it had broken three days before the accident and several times before then. Part of the rope was cut off and a fresh piece spliced on two days before the accident. At the time of the accident the rope was in use for repairing the engine dip; drawing up tubs of stone, in order to lower them back into a level shunt, while men were working in the dip. A man named Joshua Hughes (30) was turning the points to direct the tubs into the shunt when the rope broke, and the tubs running back killed him. The under-manager had been instructed to examine this rope, and on the day of the accident he reported it as safe. When examined after the accident it was manifestly unsafe and unfit for use. The under-manager was prosecuted and fined 20*l.*

The other fatal accident in this category occurred on the 7th December at Silverdale Colliery, No. 6 pit, when William Matthews (50), dataler, was killed by tubs running back down an engine dip owing to the breakage of a draw-bar hook, in which there was an old crack or flaw. No back-stay or drag was provided for use behind the journey of tubs, this being a precaution which should be adopted in such cases when practicable.

Of the non-fatal accidents three were on engine planes and dips, one of which resulted in injuries to three persons, and might have had more serious results. It occurred at Talk o'th'Hill Colliery on 27th June. The men are drawn up the engine dip in tubs at the end of the shift, and on the occasion of the accident, after one journey with men in had been drawn up, and when the empty tubs were returning, some of them got off the rails, and one tub became uncoupled and ran down into a crowd of men waiting at the bottom of the dip. A safety chain had been provided for coupling 10 tubs together when men were drawn, but at the time of the accident there were 12 tubs on the journey, and the chain was not long enough to secure them all. The extra tubs were put on without authority, but it was known to the roadman and fireman, and should not have been allowed by them, nor should the men have been allowed to congregate in a place where they were in great danger in case of an accident in the engine dip.

There were 13 non-fatal accidents on or connected with "jig dips," which are self-acting inclines from the working faces to the level roads, usually less than 100 yards long, and generally running with one ascending and one descending tub. In four cases jiggers were injured by getting their hands caught in the jig wheels. Three persons were crushed by the tubs on jig landings. Two were crushed by tubs which came unhooked, and one by forgetting to hook the empty tub. One person was injured while illegally riding up a jig, one by a chain breaking, and one was crushed by a tub while repairing in a dip. It is not surprising that there are many accidents in jig dips in North Staffordshire, owing to the shiftless and unskilful way in which many of the jig dips are fitted up, and to the inferiority of the tubs. In the engine dips, as a rule, the work is better done, but in many of the engine dips there is room for much improvement. This is a subject to which I have referred in previous reports, and I have no doubt it would conduce both to safety and economy if more attention was paid to the haulage on these roads.

By Trams and Tubs.—Two fatal and 22 non-fatal accidents. The first of these fatal accidents occurred on the 4th May at Norton Colliery, when a driver named William Gerrard (16), was thrown off a full tub on which he was riding and crushed by the tubs. The horse had jerked the tub on which he was riding, causing it to leave the rails.

The second fatal accident by tubs occurred on the 5th October at No. 3 pit, Podmore Hall Colliery, when a jigger named William Osborne (19), strained himself while lifting a tub on to the road. He did not report that he was injured to any official, and it was not known to them until four days after. He died on the 14th October, and the doctor who attended gave a certificate stating the cause of death as follows: Primary, strain of hip joint, nine days; secondary, suppurative synovitis, seven days; peritonitis, two days, pleurisy, one day. No inquest was held. Osborne was a member of a local benefit society, and an arbitration was held to decide whether his death was due to an accident, and the arbitrators found that he had received an injury in the pit from which he died.

The non-fatal accidents from trams and tubs were chiefly by drivers getting crushed by the tubs, in many cases due to want of caution, in several cases by the tubs getting off the rails, and several by drivers accidentally falling in front of tubs drawn by horses.

By Machinery Underground.—One fatal and two non-fatal accidents. The fatal accident occurred on the 15th November, at Talk o'th'Hill Colliery, to John Thomas Scragg (17), engaged in working a compressed air hauling engine. In some unknown way, while the engine was running, he got between the drum and a counter shaft, and was crushed to death. The machinery was reasonably fenced. The non-fatal accidents were both by winches used for hauling tubs up steep places.

Sundries Underground.—One fatal and 12 non-fatal accidents. The fatal accident occurred on the 5th December, at Talk o'th'Hill Colliery, when a driver was kicked on the forehead by a horse which he was following to the stables. The non-fatal accidents by sundries underground were all of a simple nature calling for no remark.

Accidents on the Surface.

Nine fatal and 30 non-fatal accidents on the surface were reported, resulting in the death of nine persons, and injuries to 30 persons.

These accidents comprise two fatal and three non-fatal accidents on private branch railways, &c. which in previous years have been recorded separately. In the preceding year the corresponding figures were two fatal and 29 non-fatal accidents.

By Machinery on the Surface.—Two fatal and four non-fatal accidents. By one of these fatal accidents Mr. Charles Challinor, the managing owner of the Glebe Colliery, Fenton, lost his life on the 13th February while examining the machinery of a pumping engine. Mr. Challinor took an active interest in the working of the colliery, and was highly respected throughout the district. The other fatal accident by machinery on the surface occurred by a workman being crushed by a mortar mill, at Clough Hall Colliery. One of the non-fatal machinery accidents occurred from the breakage of a chain while a coal crusher was being repaired; one was by a circular saw; one while putting an engine into gear; and one by the breakage of a jack-roll.

On Railways and Tramways.—Five fatal and eight non-fatal accidents. The five fatal accidents were all caused by railway trucks, three of them at colliery screens, and two on private branch railways. Of the eight non-fatal accidents five were by trucks on railways, and three by tubs on tramways. There is often a lack of caution in the movement of trucks about colliery screens, and in some cases there is not sufficient room for the work to be done safely. As far as practicable the movement of trucks should be confined entirely to certain specified persons; and in the erection of all structures near which trucks are to pass special regard should be had to leave room for the safety of persons engaged about the works or trucks.

Miscellaneous Surface Accidents.—Two fatal and 18 non-fatal accidents. One of the fatal accidents was by a cartman engaged in leading ironstone from a mine being run over by his cart, and the other was by a bricklayer falling off a scaffold while building a colliery engine house. The 18 non-fatal accidents from miscellaneous causes, were all of a simple nature not calling for remark.

Accidents not comprised in the Lists.

The following accidents, which were reported, or came to my knowledge during the year, do not appear to come within the scope of the Mines Act, and are not included as mining accidents in the tables.

On the 14th January, Job Percival (67), a pick carrier, was going to his work at Berry Hill Colliery before daylight, and before he arrived on the colliery premises he missed his road and fell over a retaining wall on to the colliery tramway and was killed.

On the 29th January, John Treviss (62), an engine wright, committed suicide by jumping down a pit shaft at Madeley Court Colliery, Salop. The shaft was in use, and was sufficiently fenced to prevent anyone inadvertently getting into it.

On the 27th February, Arthur Malam (50), got his foot run over on the railway branches at Talk o'th' Hill Colliery. He was not employed at the colliery, but was in search of work.

On the 9th August, a woman named Emma May (25), committed suicide by jumping down an old pit shaft at Hanley Colliery. She climbed on to a wall 5 ft. high surrounding the shaft.

On the 11th October, Elijah Burton (45), a miner out of employment, committed suicide by jumping down an old pit shaft at Getchfield (Salop). The shaft was being re-opened by Messrs. Exley, and was temporarily securely covered over, but Burton removed the covering in order to get into the shaft.

On the 16th October, Henry Ravers (37), got his feet run over by a locomotive engine which he was attempting to mount on the Apedale Colliery railway. He was in search of work.

On the 6th November, a lamentable accident occurred at Scott Hay, near Silverdale, by which Charles and Sarah Poulsen, man and wife, lost their lives, in their own house, and Horace Poulsen was injured, by the explosion of some gelignite which Charles Poulsen, a miner, had put in the oven to thaw, two days previously, and forgotten. This treatment of gelignite showed gross carelessness or ignorance of the nature of the explosive. The accident, however, forcibly illustrates a danger which miners too frequently incur by taking explosives to their homes. In Belgium, I believe, mine owners and others, whose workmen use explosives, are required by law to supply the explosives and to provide magazines, to which the workmen are required to return all unused explosives at the end of each shift, and it appears desirable that similar provisions should be made in this country.

Complaints from Workmen and Others.

Seventeen complaints or intimations of danger or breach of rules were received during the year, most of which were anonymous. One of them was so absurdly frivolous that it was not noticed. Early inquiry was made as to the others, and where practicable, steps were taken to remedy the matter complained of. In some cases the information supplied was of real value, and led to the removal of sources of danger. These communications are, according to instructions, regarded as confidential, no clue being given as to their source.

Prosecutions under the Act.

1. *Prosecutions by the Inspector of Mines.*—On the 1st May, at Hanley, before H. Wright, Esq., Stipendiary Magistrate, and Dr. Spanton, the agent and under-manager of Clough Hall Colliery, belonging to the Birchenwood Colliery Company, Limited, were summoned for a breach of the 5th General Rule in connexion with a fatal accident caused by the breakage of a haulage rope. The Birchenwood Colliery Company, Limited, had only taken possession of the colliery, as a going concern, nine days before the accident, and they continued to use the rope, which was known to be in a bad state of repair, and to have broken on several previous occasions. The under-manager was instructed by the agent to make a special examination of the rope, and he reported it to be all right on the day of the accident. A proper examination would have shown that it was not safe to use, being worn out and full of broken wires. The summons against the agent was withdrawn on payment of costs, and the under-manager was fined 20*l.* with 1*l.* 17*s.* costs.

On the 10th November, at Cheadle, before General Sir M. Buller, Bart., and Messrs. Bowers and Bolton, the owners of Weston Coyney Colliery (Park Hall Collieries, Limited), and the manager and under-manager were summoned for breaches of the first

General Rule (ventilation) and the 21st General Rule (securing roof and sides), and the manager for breaches of the 5th General Rule (weekly reports as to shafts) and the 130th Special Rule (fan register book). After serious complaints had been made both verbally and in writing as to the management of this colliery, it was examined in October and found to be in a wretched condition as to the ventilation and security of the roadways. Five men were found working in a place containing a dangerous accumulation of fire-damp, caused by the airway being blocked. There was an accumulation of fire-damp a few yards above a main jig landing, the place being neither ventilated nor fenced off, and there were four other accumulations of fire-damp in places fenced off, in one of which cases the gas extended beyond the outer side of the fence. Many of the roads were not in a fit state for working; some places being so unsafe that work was stopped at once until they were repaired. It was ascertained that there had been a large fall of roof on one of the travelling roads while the men were going to work the day before the inspection, but fortunately no one was caught by it, some of the men having got past the place before it fell, and others being behind. Another large fall had taken place on one of the travelling roads two days before the inspection, and a heavy fall occurred at another place during the inspection, just after it had been passed under. The weekly reports required by General Rule 5 as to the state of the shafts were not regularly made. From the beginning of the year to the 16th October, a period of 41 weeks, only 15 reports had been entered, although the pit had been working all the time except for three or four weeks during August and September. No book had been used or provided for registering the running of the fan as required by Special Rule 130. Only the summonses against the manager and under-manager were proceeded with, and these were all dismissed by the magistrates, except that against the manager for failing to provide a book for registering the speed of the fan, in which case a fine of 2*s.* 6*d.* was imposed. The defence, as to the ventilation, was that there must have been a sudden outburst of gas in the place where men were working in the presence of a dangerous accumulation of fire-damp, and as to the timbering of the roadways, the defence was that the places complained of were not dangerous, and would have been repaired in the ordinary course of working. An error of dates in the summons relating to the shaft reports led to its dismissal.

2. *Prosecutions by Mine Owners.* Reported as required by Section 66 of the Act.

25th January, at Longton.—Two jiggers, for not securing the stop block at top of self-acting incline. Fined 20*s.* and costs 22*s.* 6*d.* each.

25th January, at Longton.—A jigger, for starting loads in self-acting incline without a signal, whereby a man was injured. Fined 20*s.* and 25*s.* costs.

3rd February, at Shifnal.—A driver, for having an open lamp in his possession beyond the appointed station. Fined 20*s.* and costs 5*s.* 6*d.*

24th February, at Neston.—A collier, for unramming a charge of powder which had missed fire. Fined 10*s.* and costs 9*s.* 6*d.*

27th February, at Hanley.—A fireman, for neglecting to report an accumulation of gas and removing the same past men at work without withdrawing men. Fined 40*s.* Costs 14*s.*

16th March, at Tunstall.—A hooker-on, for leaving pit bottom before all the men were out and leaving bottom of shaft unfenced. Fined 10*s.* including costs.

4th April, at Newport (Salop).—A holer, for having a pipe in the mine. Fined 10*s.* and costs 6*s.* 6*d.*

17th July, at Newcastle.—A waggoner, for having three lucifer matches in the mine. Fined 10*s.* Costs 4*s.*

17th July, at Newcastle.—A datałer, for getting into cage contrary to orders. Fined 5*s.* Costs 9*s.*

5th October, at Tunstall.—A checkweigher, for interfering with the workmen at the mine. The stipendiary magistrate stated that he would be compelled to make an order for the removal of the checkweigher if the colliery owners pressed the case; they, however, only wanted an authoritative decision as to the checkweigher's position, and did not press the case. Costs 8*l.* 14*s.* to be paid by defendant.

9th October, at Newcastle.—An engineman in charge of ventilating fan, for being asleep while on duty. Fined 10*s.* Costs 9*s.* 6*d.*

9th October, at Newcastle.—A collier, for continuing to work with a broken safety lamp. Fined 10*s.* Costs 10*s.*

9th October, at Newcastle.—A loader, for pushing a tub into jig-dip before securing it. Fined 10*s.* Costs 9*s.*

9th October, at Newcastle.—A loader, for riding on full tub without permission. Fined 10*s.* Costs 9*s.*

25th October, at Fenton.—A fireman, for not fencing a place off which contained gas. Fined 40*s.* Costs 8*s.*

27th October, at Fenton.—A collier, for having lucifer matches in the mine. Fined 40*s.* Costs 8*s.* 6*d.*

27th October, at Fenton.—An engine dip attendant, for having a pipe in the mine Fined 40*s.* Costs 8*s.* 6*d.*

27th October, at Fenton.—A contractor, for burying timber in packs (which leads to gob-fires). Fined 40*s.* Costs 8*s.* 6*d.*

30th October, at Hanley.—A miner, for unramming a shot. Fined 20*s.* Costs 8*s.*

6th November, at Newcastle.—A collier, for having lucifer matches in the mine. Fined 10*s.* Costs 9*s.*

6th November, at Newcastle.—A fan attendant, for neglecting duties at fan, and being found asleep. Fined 10*s.* Costs 9*s.*

6th November, at Newcastle.—A loader, for riding on full tub without permission. Fined 10*s.* Costs 9*s.*

6th November, at Newcastle.—A collier, for having 2 lbs. of roburite loose on his person. Fined 10*s.* Costs 9*s.*

6th December, at Fenton.—A waggoner, for travelling in engine dip before the proper signal was given. To pay costs 8*s.*

Number of Days on which Minerals were drawn at the Mines.

The following statements, showing the number of persons employed at mines drawing minerals on different numbers of days (approximately) during the years 1890–93, are abstracted from the "Annual Returns" prepared by the mine owners. In these statements mines which were only equipped for drawing minerals during a portion of the year, or mines where the drawing of minerals was prevented for long periods by accidents or other causes, are excluded. For this reason the calculations for 1893 refer only to mines employing, in Cheshire 68·35 per cent., in Shropshire 86·58 per cent., and in North Staffordshire 93·84 per cent. of the total number of the workmen employed in and about the mines of those portions of the district. Persons employed on private branch railways, &c., are included.

Cheshire.

Number of Persons employed.	Minerals drawn on more than	Per-centages of Persons.			
		Year 1893.	Year 1892.	Year 1891.	Year 1890.
0	300 days.	—	1·42	29·69	7·18
8	290 „	0·30	·20	7·26	43·46
10	280 „	0·37	7·14	31·76	0·97
197	270 „	7·41	24·12	8·05	32·90
37	260 „	1·39	38·12	—	6·92
17	250 „	0·67	8·68	7·40	7·18
101	240 „	3·80	—	8·30	—
291	230 „	10·95	·90	—	0·62
650	220 „	24·46	7·34	6·00	0·57
0	210 „	—	—	—	—
505	200 „	19·00	4·09	—	—
1,816		68·35	92·01	98·46	99·80
841 less than 200 days.					
2,657					

Shropshire.

Number of Persons employed.	Minerals drawn on more than	Per-centages of Persons.			
		Year 1893.	Year 1892.	Year 1891.	Year 1890.
199	300 days.	5·25	11·90	13·14	7·15
549	290 „	14·50	5·62	13·27	10·20
254	280 „	6·71	5·09	1·63	25·51
247	270 „	6·55	13·26	28·86	14·53
40	260 „	1·05	26·53	10.63	9·63
5	250 „	0·13	9·37	3·86	1·10
465	240 „	12·28	6·54	11·03	2·59
1,151	230 „	30·40	1·94	1·22	14·59
263	220 „	6·94	2·50	3·33	3·63
0	210 „	—	3·36	1·14	2·28
105	200 „	2·77	4·91	2·90	1·52
3,278		86·58	91·02	91·01	92·73
508 less than 200 days.					
3,786 Total No. of persons employed.					

North Staffordshire.

Number of Persons employed.	Minerals drawn on more than	Per-centages of Persons.			
		Year 1893.	Year 1892.	Year 1891.	Year 1890.
0	300 days	—	6·48	13·26	19·25
51	290 „	0·27	19·93	34·71	36·43
2,181	280 „	11·48	23·15	19·26	11·98
3,629	270 „	19·11	6·96	4·88	9·53
2,568	260 „	13·52	21·73	13·18	5·98
1,307	250 „	6·88	6·20	6·41	6·06
2,665	240 „	14·03	5·53	1·19	0·96
3,171	230 „	16·69	1·57	·81	0·45
2,033	220 „	10·70	0·57	1·17	1·62
220	210 „	1·16	1·86	1·03	0·22
0	200 „	—	0·23	0·15	0·03
17,825		93·84	94·21	96·05	92·51
1,169 less than 200 days.					
18,994 Total No. of persons employed.					

Plans of Abandoned Mines.

The following record plans of abandoned mines or seams have been forwarded to the Home Office during 1893, for preservation by the Secretary of State as required by section 38 of the Coal Mines Regulation Act. No person except an inspector under the Act is entitled, without the consent of the owner of the mine, to see the plans so deposited until after the expiration of 10 years from the time of the abandonment. A list of all plans of abandoned mines deposited at the Home Office is published separately.

North Staffordshire Collieries.

Berry Hill Colliery. Folly Pit, Peacock Seam (coal).

Cobridge Colliery. Gubbin Ironstone.

Florence Colliery. Moss Coal.

Froghall Iron Ore Mine. Red Hydrate.

Gorsty Bank Colliery. Half yard Seam (coal and ironstone), Red Shagg (ironstone), Red Mine (ironstone).

Greenfield Colliery. Peacock Seam (coal), Spencroft Seam (coal).

Grove Colliery (Silverdale). Blackband, Red Shagg and Red Mine (ironstone Seams).

Lane Ends Colliery (Tunstall). Rowhurst Coal.
New Packmoor Colliery. Burnwood Ironstone, Burnwood Coal and Twist Coal.
Whitebarn Colliery. Great Row Coal. Little Row Coal.

Shropshire Collieries.

Boycott Colliery. Half Yard Coal. Yard Coal. Thin Coal.
Madeley Wood Colliery. Hills Lane Pit. Pennystone Ironstone, and New Mine Coal.
Wombridge Colliery. Nabbside Pit. Clunch Coal.

Cheshire Colliery.

Bredbury Colliery. Bent's Lane Pit, Black Mine (coal). Two feet and Peacock Mines (coal). Stone Mine (coal). Woodley or New Mine (coal).

Under Managers' Certificates of Service.

The application of two colliery officials for certificates of service as Under Managers were referred to me during the year.

I reported after inquiry that in one case the applicant was entitled to a certificate, and in the other case that he was not.

Board for Examinations for Certificates.

A vacancy on the Board occurred during the year by the death of Mr. Robert Heath, of Biddulph Grange, Colliery owner. To fill the vacancy thus caused you appointed Mr. Robert Heath, of Greenway Bank, son of the late member of the Board.

The constitution of the Board is as follows :—

Mr. Robert Heath, Greenway Bank, Stoke-on-Trent Mr. W. Y. Craig, Milton, Alsager Mr. H. Warrington, Stoke-on-Trent	Mine owners.
Mr. Noel T. Beach, Lilleshall, Salop Mr. G. C. Greenwell, Poynton, Stockport Mr. J. Strick, Barr Hill, Madeley, Staffs.	Mining engineers.
Mr. H. Martin, St. George's, Wellington, Salop Mr. J. Bennett, Hazelgrove, Stockport Mr. C. Grocott, Silverdale, Staffs.	Working miners.

W. N. Atkinson, H.M. Inspector of Mines for the district.
Secretary to the Board, Mr. Jos. Knight, Newcastle, Staffs.

The examiners appointed by the Board for conducting the examinations were Messrs. G. C. Greenwell, J. Strick, and Ed. Jones.

The annual examination was held at Newcastle-under-Lyme on the 27th and 28th June. Twenty-two candidates presented themselves, of whom 8 were candidates for first-class certificates and 14 for second-class certificates. Two of the candidates for first-class certificates and 10 for second-class certificates were successful. Official lists of all persons holding certificates as managers and under-managers of mines are published.

Exemptions.

The following exemptions from certain of the provisions of the Coal Mines Regulation Act, were granted during the year :—

1. *Granted by the Secretary of State.*—Exemption from provision prohibiting single shafts on account of insufficiency of mineral proved, section 18 (ii.) (*a*). Granted to the Broseley Tileries Company, Limited, for their Dunge Pit. Expires 30th June 1894.

Exemptions from the regulation as to cartridges (section 49 General Rule 12 (*b*)) were granted to the following mine owners for mines in the Broseley district of Shropshire, where red tile clay is the principal mineral worked :—The Broseley Tileries Company, Limited, Messrs. G. and F. Davis, Messrs. Exley and Sons, Mr. R. D. Haughton, Messrs. Jones Bros., Messrs. W. and P. Jones, Mr. C. R. Jones, Messrs. G. Legge and Son, Messrs. Maw and Company, Limited, Messrs. Oakes and Pumford, and Messrs. Prestage and Company.

2. *Granted by the Inspector of Mines.*—The following temporary exemptions from the provisions requiring guides in the shafts (section 49, General Rule 25) were granted during the year :—In Staffordshire, No. 18 Shaft, Clough Hall Colliery, belonging to the Birchenwood Colliery Company, Limited (expired). Harecastle Shaft, belonging to same Company (expired). In Cheshire, Nos. 1 and 2 Shafts, Lingard Lane Colliery, belonging to Messrs. J. and R. Stott-Milne (both expired). In Shropshire, the Nabb Shaft belonging to the Lilleshall Company, Limited, expires 30th June 1894. Tuckies Pits (two shafts) belonging to Messrs. Maw and Company, Limited, expires 31st December 1895.

Miners' Relief Funds.

The North Staffordshire Miners' Permanent Relief Fund continues to do an important work. The general secretary informs me that on the 31st December 1893, the number of members was 6,789, being an increase of 444 over the previous year. Sixteen members were killed during the year, leaving nine widows and 25 children to receive benefit from the fund, and 829 of the members received benefit for non-fatal accidents. Members' entrance fees and contributions amounted to 4,533*l.* 12*s.* 7*d.*, and colliery owners' subscriptions to 304*l.* 12*s.* 1*d.* during the year. Members of the fund are in no cases required to contract out of the Employers' Liability Act. There is room for a large increase in the number of members of the fund, and in my opinion every miner in the district should join it.

A Parliamentary Return was issued on 2nd August 1893, with particulars of Colliery Accident Funds in Great Britain raised by public subscription. The following extract from the return relates to such funds in this district.

North Staffordshire District.

Name of Fund.	Date of Foundation.	Amount of Surplus.	Number of Persons at present receiving Relief.	Number of Persons receiving Relief who have been receiving Relief from the Date of the Foundation of the Fund.	Number of Persons now receiving Relief who have become Recipients since the Foundation of each Fund.
The Longton Colliery Explosion Fund.*	October 1889 -	£ s. d. 7,518 2 10 Balance in hand on 24th April 1893.	28 widows. 65 children. (The actuary's report of 14th March 1890 shows, 39 widows, 88 children, 12 dependent relatives, then receiving relief.)	28 widows. 65 children.	None.
The Hyde Colliery Explosion Fund.†	January 1889	£ s. d. 5,218 8 3 Balance in hand on 31st December 1892.	27	24	3
Talk-o'-th'-Hill Colliery Explosion Fund.‡	1867 - -	Present balance in hand, between 6,000*l.* and 7,000*l.*	20	6	100 cases have been relieved within the last two years.
Total - - -	- - - -	19,236 11 1 (about.)	140	123	103

* Mossfield Colliery Explosion occurred on the 16th October 1889, causing the loss of 64 lives.
† Hyde Colliery Explosion occurred on the 18th January 1889, causing the loss of 23 lives.
‡ Talk-o'-th'-Hill Colliery Explosion occurred on the 13th December 1866, causing the loss of 91 lives.

OFFICIAL DUTIES.

During the year 1893 I was from home on official business on 294 day and 22 nights, and travelled a distance of about 10,300 miles. I visited 260 collieries and mines, being underground on 103 occasions; I attended 20 inquests. On five days I was engaged at solicitors' offices and police courts, and on seven days I was at the Home Office. I attended one meeting at the Board for examinations and was present on part of two days at the annual examination for certificates. Only ten days were entirely occupied with office work at home, the bulk of this work being done on days partially devoted to inspections. I had ten days' leave of absence during the year.

Mr. H. R. Makepeace continues to assist me efficiently in the general work of the district. He informs me that during the year 1893 he was officially engaged on 301 days, six of which were occupied by office work at home. He travelled 9,127 miles on official business, made 233 underground, and 42 surface inspections, attended 16 inquests, and was engaged nine days at solicitors' offices, county courts, and police courts. He had 12 day, leave of absence during the year.

GENERAL REMARKS.

The year 1893 has been a checkered one for the coal trade. During the seven earlier months of the year prices were generally unremunerative; then came the demand, in most of the Midland districts, for a large reduction in wages, resulting in one of the most serious labour disputes which has ever taken place in this country. In the greater portion of this district, viz., North Staffordshire and Shropshire, the colliery owners did not give notice for the reduction, notwithstanding which there was a general stoppage in North Staffordshire and a partial stoppage in Shopshire of from three to four weeks. When work was resumed there was naturally a great demand for coal, and very high prices were realized until the miners in the other districts returned to work. Since then to the present time prices have been fairly remunerative, although the demand for coal has already fallen off to such an extent that some pits are working short time. The iron trade of the district continued in a depressed state throughout the year, and there is a further considerable reduction in the output of ironstone. No general change has taken place in the rates of wages or hours of work during the year.

By your instruction, a circular was sent out in March last calling attention to the risks attending the use of petroleum, paraffin, and other mineral oils underground without sufficient precautions being taken, and to the desirability of making known to the underground workmen the way of exit by the second outlets in cases of emergency, such as a fire. This communication I am pleased to say, has resulted in the abolition of a number of "flaming" or "torch" lamps, such lamps being a most dangerous means of lighting underground. Steps have also been taken, in most cases where it was necessary, to acquaint the underground workmen with the route to the second outlet, by fixing notice boards and causing parties of the men to travel the route at intervals, and this practice should be maintained. The disastrous result which may be caused by an underground fire has again been exemplified during the year by the accident at Thornhill Colliery in Yorkshire, where 139 lives were lost. The origin of the fire there was a local explosion of fire-damp in the downcast shaft, but it is officially reported that the great loss of life was entirely due to the after-damp and smoke from the fire being carried through the workings of the pit by the ventilating current.

The use of "safety" or so-called "flameless" explosives continues to increase in this district, by displacing gunpowder; those chiefly used being roburite and ammonite, trials being also made of ardeer powder and bellite. The water or gelatinous cartridge also continues in use, with gelignite and tonite. No case has come to my knowledge of any injury received from the fumes produced by any of these explosives, and although I have made inquiries of the workmen in several of the pits no complaint was made on the subject. The wisdom of adopting those safer explosives (with electrical firing) in dusty or fiery pits, is not to be doubted, and as further legal instructions are not unlikely to be imposed on the use of gunpowder in coal mines, those who adopt them now will then have the benefit of their experience as well as the present increased safety.

The substitution of these safer explosives for gunpowder, coupled with the spreading conviction that coal dust is the most important factor in extensive colliery explosions, and that it may be the sole cause of such disasters, will, I anticipate, have a marked effect in reducing the loss of life by explosions in coal mines. At the same time the desirability

of taking additional precautions against coal dust should not be overlooked, because explosives are not the only means by which coal dust may be ignited. This aspect of the question has not received much practical attention in this district, and I would urge on the colliery owners and managers that further precautions should be taken by effectually damping roads containing inflammable dust, or by dividing the mines into sections separated by lengths of roadways kept free from coal dust.

PART II.—MINES UNDER THE METALLIFEROUS MINES REGULATION ACTS.

The metalliferous mines in my district comprise gypsum mines in Staffordshire, limestone and salt mines in Cheshire, and barytes, lead, zinc, and limestone mines in Shropshire. Lead and zinc mining, usually carried on in conjunction, is a declining industry, owing to the low prices of those minerals, and it appears probable that it may become almost extinct in Shropshire.

Persons employed and Minerals raised.

Table showing the Persons employed and Minerals raised at Mines under the Metalliferous Mines Regulation Act, in the North Stafford Inspection District during the year 1893.

Counties.	Number of Persons employed			Tons of Minerals wrought.						
	Under-ground.	Above-ground.	Total.	Barytes.	Gypsum.	Lead Ore.	Lime-stone and Calc spar.	Salt (Rock).	Zinc Ore.	Total.
Cheshire - - -	191	26	217	—	—	—	4,141	—	—	155,018
Shropshire - - -	253	129	382	5,852	—	1,800	3,741	150,877	398	11,791
Staffordshire, North - -	54	41	95	—	24,564	—	—	—	—	24,564
Totals 1893 - -	498	196	694	5,852	24,564	1,800	7,882	150,877	398	191,373
Totals last year 1892	584	283	867	6,168	22,254	2,112	2,717	138,753	409	172,413

Details as to the sex and ages of the persons employed will be found in Table No. 3 of the summaries.

Accidents.

There were no fatal accidents at the metalliferous mines of the district in 1893, and only one non-fatal accident was reported, a small fall of stone crushing a man's finger.

I am, &c.
(Signed) W. N. ATKINSON.

The Right Hon. H. H. Asquith, Q.C., M.P.,
Her Majesty's Principal Secretary of State,
Home Office, Whitehall.

MINES CLASSED under the COAL MINES REGULATION ACT.

LIST of the FATAL ACCIDENTS, and DEATHS arising therefrom within one Year and a Day from the Date of the Accident, in MR. W. N. ATKINSON'S DISTRICT, consisting of NORTH STAFFORDSHIRE, CHESHIRE, and SHROPSHIRE, during the Year 1893.

No. of Accident.	Date and Hour of the Accident.	Hour of the Person's Shift, i.e., No. of Hours he had been at Work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed or injured.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Firedamp and Coal Dust.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Aboveground.	Total.
1	1893. Jan. 10 7.0 a.m.	1	Great Fenton, Pender pit.	Stoke-on-Trent, Staffs.	Stafford Coal and Iron Co., Ltd.	Geo. Brunt -	18	Jigger -	Struck on head by a post which was knocked out by stone barred down by a miner in Bassey Mine. He was away from his place of work. Died 28th January.	–	1	–	–	–	1
2	Jan. 19 4.15 p.m.	1¾	Talk-o'-th'-Hill	Talk-o'-th'-Hill, Staffs.	Talk-o'-th'-Hill Colliery Co., Ltd.	Saml. Lawton -	19	Dataler -	Fall of roof while building packwall at longwall face in Bullhurst Seam.	–	1	–	–	–	1
3	Jan. 19 1.0 p.m.	7	Clough Hall, Speedwell pit.	Harecastle, Staffs.	Birchenwood Colliery Co., Ltd.	Jos. Windle -	17	Jigger -	Fall of roof during repairs on a jig road in 8-ft. Banbury Seam. Died 20th January.	–	1	–	–	–	1
4	Jan. 19 12.45p.m.	6¾	Apedale (Branch Railway).	Newcastle, Staffs.	Midland Coal, Coke, and Iron Co., Ltd.	Sidney Cornes -	14	Waggon-inspector.	Crushed between trucks while attempting to pass between them.	–	–	–	–	1	1
5	Jan. 23 5.30 a.m.	6	Silverdale, No. 6 pit.	" " -	Butterley Co., Ltd. -	John Hemming-	32	Loader -	Fall of roof at working face in a flitching in the Hams Seam.	–	1	–	–	–	1
6	Feb. 4 10.30a.m.	3½	Knutton Manor	" " -	Knutton Manor Mining Co., Ltd.	John Robinson -	65	Cartman -	Run over by cart on surface -	–	–	–	–	1	1
7	Feb. 11 10.45p.m.	3¾	Clough Hall, No. 6 pit.	Harecastle, Staffs.	Birchenwood Colliery Co., Ltd.	Joshua Hughes -	30	Roadman -	Crushed by tubs in engine dip, owing to hauling rope breaking at a socket or cap.	–	–	–	1	–	1

List of Fatal Colliery Accidents—*continued.*

No. of Accident.	Date and Hour of the Accident.	Hour of the Person's Shift, i.e., No. of Hours he had been at Work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed or injured.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Firedamp and Coal Dust.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Aboveground.	Total.
8	1893. Feb. 13 3.0 p.m.	—	Glebe -	Stoke-on-Trent, Staffs.	John Challinor & Co., Ltd.	Chas. Challinor -	64	Colliery owner, &c.	Crushed by pumping engine while examining machinery.	–	–	–	–	1	1
9	Feb. 17 2.0 a.m.	9	Berry Hill, Railway pit.	" " -	H. Warrington & Son -	John B. Tansley	17	Stoker -	Fell down shaft from pump insett -	–	–	1	–	–	1
10	Mar. 15 10.0 a.m.	4	Whitfield -	Tunstall, Staffs.	Chatterley - Whitfiel Co., Ltd.	Jos. Potts -	24	Shunter -	Fell in front of trucks while lowering them to screens, and was run over.	–	–	–	–	1	1
11	Mar. 19 3 p.m.	9	Talk-o'-th'-Hill	Talk-o'-th'-Hill, Staffs.	Talk-o'-th'-Hill Colliery Co., Ltd.	Jas. Warren -	37	Shaftman -	Fell out of cage while taking an iron bar, 7 ft. long, down the pit. He put the end of the bar through the bottom of the cage, and it probably caught against something and knocked him out of the cage.	–	–	1	–	–	1
12	Mar. 22 6.45 a.m.	$\frac{3}{4}$	Harecastle, Moss pit.	Harecastle, Staffs.	Bidder and Elliot -	Geo. Whitehurst	46	Collier -	Fall of coal from the side of a narrow place at the working face in the Bullhurst Seam. The coal should have been spragged.	–	1	–	–	–	1
13	Apr. 19 11.15a.m.	$5\frac{1}{4}$	Florence -	Longton, Staffs.	Florence Colliery Co., Ltd.	Jos. Lomas -	32	Sinker -	Fell down shaft off a scaffold. He came down in a bowk, and jumped out before it reached the scaffold, and fell over or under a chain fencing, an open space at one side of the scaffold.	–	–	1	–	–	1
14	May 4 10.30a.m.	$4\frac{1}{2}$	Norton -	Stoke-on-Trent, Staffs.	R. Heath & Sons -	Wm. Gerrard -	16	Driver -	Fell off tubs drawn by a horse, and was crushed under tub. Died 6th May.	–	–	–	1	–	1

List of Fatal Colliery Accidents—*continued.*

No. of Accident.	Date and Hour of the Accident.	Hour of the Person's Shift, *i.e.*, No. of Hours he had been at Work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed or injured.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Firedamp and Coal Dust.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Aboveground.	Total.
15	1893. May 6 12.45p.m.	5¾	Sneyd -	Burslem, Staffs.	Sneyd Colliery and Brickworks Co., Ltd.	Wm. Powell -	28	Screening Contractor.	Crushed between trucks while assisting to place them at screens.	–	–	–	–	1	1
16	May 8 3.0 p.m.	8	Hulme -	Longton, Staffs.	J. & C. Waine -	Elijah Steele -	57	Collier -	Suffocated by gunpowder smoke -	–	–	–	1	–	1
17	May 12 6.30 a.m.	½	Silverdale, Kent's Lane pit.	Newcastle, Staffs.	Butterley Co., Ltd. -	Geo. Meadon -	55	Bricklayer -	Fell off scaffold while building engine-house on surface.	–	–	–	–	1	1
18	May 15 8.0 a.m.	2	Biddulph Valley, Havelock pit.	Biddulph, Staffs.	R. Heath & Sons -	David Yates -	32	Timberer -	Fall of roof while repairing roadway in Hard Mine.	–	1	–	–	–	1
19	July 3 3.15 p.m.	1¼	Biddulph Valley, Sinking pit.	" " -	" " -	John Moss -	26	Sinker -	Fall of stone from side of shaft 10 yards above where he was walling.	–	–	1	–	–	1
20	July 27 11.30p.m.	8½	Silverdale, No. 6 pit.	Newcastle, Staffs.	Butterley Co., Ltd. -	Frank Foster -	17	Dataler -	Fall of coal forming roof of horse level in 10-ft. seam, while he was cleaning the gutter.	–	1	–	–	–	1
21	July 28 11.30p.m.	3	Shelton, Rowhurst pit.	Hanley, Staffs.	Shelton Iron, Steel, and Coal Co., Ltd.	Benj. Cotton -	48	Butty-Collier	A fall of coal accompanying a "Goth" knocked out a post which fell on his head at working face in Rowhurst Seam.	–	1	–	–	–	1
22	Sept. 6 6.0 p.m.	0	Slip pit	Broseley, Salop	Jones Bros. - -	John Morris -	40	Miner -	Fell from "doubles" while descending shaft. Instead of being seated in the chain loop, he was standing with his foot in it.	–	–	1	–	–	1
23	Sept. 15 4 45 p.m.	9¾	Clough Hall -	Harecastle, Staffs.	Birchenwood Colliery Co., Ltd.	Noah Leadbitter	57	Labourer -	Crushed by crank of mortar-mill engine, while a belt was being repaired.	–	–	–	–	1	1

List of Fatal Colliery Accidents—*continued.*

No. of Accident.	Date and Hour of the Accident.	Hour of the Person's Shift i.e., No. of Hours he had been at Work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed or injured.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Firedamp and Coal Dust.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Aboveground.	Total.
24	1893. Sept. 19 1 p.m.	7	Berry Hill, Deep pit.	Stoke-on-Trent, Staffs.	H. Warrington & Son -	Thos. Podmore -	49	Collier -	Fall of roof while getting down top coal in longwall in Yard Seam.	–	1	–	–	–	1
25	Sept. 27 8.30 a.m.	2½	Silverdale, No. 6 pit.	Newcastle, Staffs.	Butterley Co., Ltd. -	Philip Rhodes -	53	" -	Fall of coal from side while flitching air-head in 8-ft. seam.	–	1	–	–	–	1
26	Sept. 28 7.30 a.m.	1½	Oldfield - -	Longton, Staffs.	Longton Hall Co. -	Felix Warren -	38	" -	Large fall of roof at top of jig-road at longwall face in Yard Coal Seam. Two others injured.	–	1	–	–	–	1
27	Oct. 6 11.0 p.m.	9	Podmore Hall, No. 3 pit.	Newcastle, Staffs.	Midland Coal, Coke, and Iron Co., Ltd.	Wm. Osborne -	18	Jigger -	Said to have strained his hip while lifting a tub on to the rails. He died on the 14th October. The doctor who attended him gave a certificate stating as cause of death:—Primary, strain of hip joint; secondary, suppurative synovitis, peritonitis, pleurisy. No inquest was held (*see* Report, p. 12).	–	–	–	1	–	1
28	Oct. 14 3.15 p.m.	1¼	Shelton, Deep pit.	Hanley, Staffs.	Shelton Iron, Steel, and Coal Co., Ltd.	Harry Maddock	25	Repairer -	Fall of stone from side while repairing main level crut.	–	1	–	–	–	1
29	Oct. 17 2.30 p.m.	8½	High Carr -	Newcastle, Staffs.	Representatives of the late J. H. Williamson.	Charles Davis -	36	Collier -	Fall of roof at working face in Red Shagg Ironstone Seam.	–	1	–	–	–	1
30	Oct. 17 7.0 p.m.	3	Shelton, Deep pit.	Hanley, Staffs.	Shelton Iron, Steel, and Coal Co., Ltd.	Wm. Wordley -	16	Dirt-picker	Crushed between buffers of trucks at screens.	–	–	–	–	1	1
31	Nov. 8 4.30 p.m.	1	Glebe -	Stoke-on-Trent, Staffs.	Jno. Challinor & Co., Ltd.	Humphrey Ward	27	Collier -	Crushed against jig-post by fall of roof at longwall face in Moss Seam.	–	1	–	–	–	1

List of Fatal Colliery Accidents—*continued.*

No. of Accident.	Date and Hour of the Accident.	Hour of the Person's Shift i.e., No. of Hours he had been at Work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed or injured.	Reputed Age.	Occupation.	Cause of Accident and Remarks.	Lives lost. Explosions of Firedamp and Coal Dust.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Udderground.	Aboveground.	Total.
32	1893. Nov. 14 2.30 p.m.	8½	Clough Hall	Kidsgrove, Staffs.	Birchenwood Colliery Co., Ltd.	Elijah Baker	29	Loco-guard	Run over by trucks while attempting to sprag a wheel with a piece of rail weighing 81 lbs.	–	–	–	–	1	1
33	Nov. 15 2.30 p.m.	8½	Talk-o'-th'-Hill	Talk-o'-th'-Hill, Staffs.	Talk-o'-th'-Hill Colliery Co., Ltd.	J. T. Scragg	17	Engine-tenter.	Crushed by drum of underground hauling engine.	–	–	–	1	–	1
34	Nov. 28 11.45 a.m.	6¼	Podmore Hall, Minnie pit.	Newcastle, Staffs.	Midland Coal, Coke, and Iron Co., Ltd.	Jas. Chell	61	Collier	Fall of top coal in working place in Bullhurst Seam. Died 13th December 1893.	–	1	–	–	–	1
35	Nov. 28 8.15 a.m.	2¼	Leycett Colliery, Fair Lady pit.	" "	Madeley Coal and Iron Co., Ltd.	Augustus Fox	38	"	Fall of coal from roof at working face in rearers. 7-ft. Banbury Seam.	–	1	–	–	–	1
36	Dec. 2 12.45 p.m.	7¾	Hem Heath	" "	Hem Heath Mining Co.	Wm. Blurton	38	Miner	Explosion of fire-damp in Red Mine Ironstone Seam. Died 12th December 1893.	1	–	–	–	–	1
37	Dec. 5 11.30 p.m.	8½	Talk-o'-th'-Hill	Talk-o'-th'-Hill, Staffs.	Talk-o'-th'-Hill Colliery Co., Ltd.	John Wainwright	17	Driver	Kicked on forehead by a horse which he was following to stables.	–	–	–	1	–	1
38	Dec. 7 6.30 p.m.	3½	Silverdale, No. 6 pit.	Newcastle, Staffs.	Butterley Co., Ltd.	Wm. Mathews	50	Dataler	Crushed by tubs at bottom of engine dip, owing to the draw-bar of a tub opening out and allowing the tubs to run back.	–	–	–	1	–	1
39	Dec. 15 2.15 p.m	8¼	Apedale, Burley pit.	" "	Midland Coal, Coke, and Co., Ltd.	Geo. Fisher	27	Collier	Large fall of roof while drawing timber in the 7-ft. seam.	–	1	–	–	–	1
40	Dec. 19 1.30 p.m.	7½	Hem Heath	" "	Hem Heath Mining Co.	Wm. Mainwaring	37	"	Fall of ironstone while he was holing in the Red Mine. It should have been better spragged. Died 29th December 1893.	–	1	–	–	–	1

List of Fatal Colliery Accidents—*continued.*

No. of Accident.	Date and Hour of the Accident.	Hour of the Person's Shift, *i.e.*, No. of Hours he had been at Work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed or injured.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost.					
										Explosions of Firedamp and Coal Dust.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Aboveground.	Total.
41	1893. Dec. 29 6.30 a.m.	½	Bunker's Hill -	Talk-o'-th'-Hill, Staffs.	W. Rigby & Co. -	Jas. Finch -	52	Miner -	Fell down a staple pit 20 yds. deep, owing to the breakage of a hemp rope.	–	–	1	–	–	1
									Total - - -	1	18	6	7	9	41

Report of Assistant Inspector.

Newcastle, Staffordshire,
12th March 1894.

SIR,

IN accordance with section 20 of the Metalliferous Mines Regulation Act, 1872, I have the honour to report that during the year 1893 I exercised the duties of Inspector of Mines in the district of North Staffordshire, Cheshire, and Shropshire, and that in doing so I acted as assistant to and under the direction of Mr. W. N. Atkinson, the Inspector in charge of the district.

I have, &c.
(Signed) HUGH R. MAKEPEACE.

The Right Hon. H. H. Asquith, Q.C., M.P.,
Her Majesty's Principal Secretary of State,
Home Office, Whitehall.

MINES.

REPORT

OF

J. M. RONALDSON, Esq., H.M. INSPECTOR OF MINES

FOR THE

WEST SCOTLAND DISTRICT (No. 2),

TO

HER MAJESTY'S SECRETARY OF STATE,

UNDER

The Coal Mines Regulation Act, 1887, the Metalliferous Mines Regulation Acts, 1872 and 1875, and the Slate Mines (Gunpowder) Act, 1882;

For the Year 1893.

Presented to both Houses of Parliament by Command of Her Majesty.

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Mr. Ronaldson's Report.

Report upon the Inspection of Mines in the Western District of Scotland for the Year ending 31st December 1893, by J. M. Ronaldson, Esq.

Sir, 44, Athole Gardens, Glasgow, 13th March 1894.

In compliance with section 43 of the Coal Mines Regulation Act and section 20 of the Metalliferous Mines Regulation Act, I have the honour, as Inspector in charge of West Scotland District, to submit to you the following report for the year ending 31st December 1893.

The district includes the counties of Argyle, Ayr, Dumbarton, Dumfries, Kirkcudbright, Renfrew, Wigtown, and the western portions of the counties of Lanark and Stirling. No mining operations at present are being carried on in the counties of Kirkcudbright and Wigtown, while in the counties of Argyle and Dumfries mining is carried on to a comparatively very limited extent. The area of the district was extended five years ago so as to include the parishes of Blantyre, Bothwell, Dalziel, and East Kilbride, in Lanarkshire, and during the past year there were employed in and about the mines in these parishes 8,959 persons, with an output of 3,255,976 tons of mineral.

Mines Worked under the Coal Mines Regulation Act.

Persons employed.

The total number of persons employed in and about the mines was 37,589. This includes the persons employed on private branch railways and in washing and coking coal, who since 1888 in the summaries have been kept apart from the other persons employed above ground. Comparing this with the corresponding figures for the previous year, there is a decrease of 440 in the number of persons employed. The persons employed on private branch railways and in coking and washing coal last year numbered 1,201, as compared with 1,133 the preceding year, and the persons thus employed are taken into account along with the others employed above ground throughout this report. The following is a summary of the persons employed, arranged in counties, and according to sex and age.

County.	Underground.			Above Ground.—Ages.							Total above and below Ground.
	Ages.			12 to 16.				Above 16.		Total.	
	12 to 16.	Above 16.	Total.	Boys 12 to 13.	Girls 12 to 13.	Boys 13 to 16.	Girls 13 to 16.	Females.	Males.		
Argyle and Dumfries	17	238	255	—	—	1	—	—	66	67	322
Ayr - - -	1,421	9,438	10,859	13	2	204	5	—	1,841	2,065	12,924
Dumbarton - -	139	1,769	1,908	—	—	50	—	18	470	538	2,446
Lanark (part of) -	1,369	14,143	15,512	4	—	307	35	162	2,692	3,200	18,712
Renfrew - -	48	704	752	—	—	7	—	—	163	170	922
Stirling (part of) -	141	1,593	1,734	— 3	—	73	8	10	435	529	2,263
Total - -	3,135	27,885	31,020	20	2	642	48	190	5,667	6,569	37,589
Total in 1892	3,207	28,276	31,483	20	1	626	46	148	5,705	6,546	38,029

It will be observed on referring to the above summary that while there is a decrease of 463 during the year of the number of persons employed below ground, there is an increase of 23 persons employed above ground, and that this increase is entirely caused by the numbers of additional boys, girls, and women employed. This is due to the introduction of cleaning coal by hand picking, and for this purpose female labour is being more extensively taken advantage of than hitherto. While in many quarters there has been a demand that the employment of women at collieries should be prohibited, I do not think there can be any valid reason why work of this nature should not be encouraged as regards the employment of women. The occupation is more healthy than that of many factory workers, the labour is not too severe, and I understand that the wages earned compare favourably with what can be secured from other occupations open to female workers in mining localities.

Output of Minerals.

The total output of minerals for the year amounted to 11,598,074 tons, being a decrease of 945,666 tons as compared with the previous year. By referring to the following table the difference between the output of the various mineral for the last two years will be seen:—

Kind of Mineral.	Output in 1893.	Output in 1892.	Increase.	Decrease.
Coal	10,572,967	11,472,947	—	899,980
Fireclay	299,393	313,050	—	13,657
Ironstone	670,600	704,642	—	34,042
Oil shale	23,855	22,281	1,574	—
Other minerals	31,259	30,820	439	—
Totals	11,598,074	12,543,740	2,013	947,679

There is thus a falling off in the output of coal of no less than 899,980 tons, while the decrease in fireclay and ironstone amounts to 13,657 tons and 34,042 tons respectively.

Arranged in counties, the year's output is given in the subjoined table:—

County.	Output in Tons.					
	Coal.	Fireclay.	Ironstone.	Other Minerals.	Total, 1893.	Total, 1892.
Argyle and Dumfries	103,776	211	—	—	103,987	95,871
Ayr	3,325,934	93,275	395,349	2,118	3,816,676	4,007,475
Dumbarton	437,541	25,269	81,164	6,061	550,035	576,582
Lanark (part of)	6,083,927	145,339	72,970	10,861	6,313,097	6,942,778
Renfrew	80,249	35,299	121,117	19,125	255,790	317,437
Stirling (part of)	541,540	—	—	16,949	558,489	603,597
Total	10,572,967	299,393	670,600	55,114	11,598,074	12,543,740

The annexed table gives the average number of days on which mineral was drawn from the mines of each county during the year, and the average output per person employed, together with the corresponding figures for the two preceding years.

County.	Average Number of Days on which Mineral was drawn.			Average Output in Tons per Person employed.		
	1893.	1892.	1891.	1893.	1892.	1891.
Ayr	271	291	288	295	318	311
Dumbarton	251	268	280	225	261	255
Lanark (part of)	244	266	262	337	372	366
Stirling (part of)	243	252	265	247	313	304
Other counties	281	284	276	289	274	273
Whole district	257	276	274	308	339	334

Referring to this table, it will be seen that on the average each mine was worked on 19 days fewer than during the previous year. This was doubtless principally caused by the restrictive policy pursued by the miners for a considerable time in reducing their working days to four per week as well as by a strike, towards the end of November, of 16 days. The figures given above show that the average output per person employed amounted to 308 tons, or 31 tons less than the previous year, but seeing that 1201 persons employed on branch railways and in washing and coking coal are included in the number of persons employed this year, and which were not included previously, the output per person employed compared with the previous years was really 318 tons, or a decrease of 21 tons, taking the same data for each year.

Accidents.

I received notice, in accordance with section 35 of the Coal Mines Regulation Act, of 273 separate accidents to persons employed in or about the mines, as compared with 312 the previous year, and of these 42 proved fatal to 45 persons, which is a decrease of 16 fatal accidents and 13 deaths. The ratios of persons employed per life lost and of mineral raised per life lost are much more favourable than those for the preceding year. One person out of every 835 employed lost his life, compared with one out of every 634 during 1892, while the quantities of mineral raised per life lost during the two years were 257,735 and 209,062 tons respectively.

Of the 42 fatal accidents, 38 happened in or about coal mines, and the other four took place at ironstone mines. The non-fatal accidents numbered 231, and by these 251 persons were injured.

I annex a table giving the numbers of deaths from the various kinds of accidents, the per-centage of each in the district and in the whole kingdom, together with the corresponding figures for the non-fatal accidents in the district:—

——	By Explosions of Firedamp or Coal Dust.	By Falls of Roof and Sides.	In Shafts.	By Miscellaneous Accidents Underground.	On Surface.
Number of deaths in district - -	3	19	6	10	7
Percentage of deaths in district -	6½	42½	13½	22	15½
„ „ kingdom -	15	39	9½	25	11½
Number of persons injured in district	46	103	14	64	24
Percentage of persons injured in district.	18½	41	5½	25½	9½

Explosions of firedamp.—The fatal explosions numbered two, and resulted in the loss of three lives, while the previous year there were also two, with a loss of two lives.

The first fatal explosion happened in No. 3 Pit, Herbertshire, Denny, and by it two persons were killed and other five injured. In accordance with section 45 of the Coal Mines Regulation Act, you directed a formal investigation of this explosion to be made, and appointed Mr. Charles J. Guthrie, advocate, and myself to hold the investigation, which was accordingly held in the Sheriff Courthouse, Stirling, on 12th and 13th September. The report based upon our investigation was forwarded to you, and has since been published, so that it is unnecessary here to enter into all the particulars. I made my usual investigation of the explosion the day following that on which it happened, and thereafter I sent a report thereon to the Procurator Fiscal, who also made an investigation in the usual manner. Previous to your directing a formal investigation to be made, there appeared in the newspapers copies of a letter to the Secretary of State from Mr. R. Chisholm Robertson, a miner's agent, requesting on behalf of the miners that a public inquiry be made, on the ground that the miners had no confidence in the investigations of the Inspector of Mines and the Procurator Fiscal. I presume that before making this statement he would satisfy himself that he had grounds for such a complaint, but although he represented the workmen at the inquiry, and every facility was afforded him both in making an inspection of the mine and producing any witness whom he wished to examine, the result of his examination was that nothing of any importance bearing on the explosion was brought to light which had not previously been referred to in my report, a copy of which was provided for his use.

There can be no doubt that this explosion was caused by one of the miners, named John Hamilton, and who was also injured, or by a fellow workman, opening a safety lamp and exposing the naked light, which ignited some firedamp, and this in turn ignited the coal dust in the roadway leading from his working place. Hamilton was arrested, lodged in prison, and charged with causing the explosion. He was afterwards liberated on bail, and after having appeared as a witness at the formal investigation, the charge against him was withdrawn by the directions of the Lord Advocate. Since this explosion, two workmen employed in this mine have been prosecuted for opening their safety lamps. The first offender was let off with a fine of 2*l*., but in the second case, the sheriff did what is very much required, viz., imposed the sentence of 30 days' imprisonment without the option of a fine.

The other fatal explosion of firedamp happened in Hattonrig Colliery to a fireman, who, previous to entering some old workings with two men to lift rails, lighted his safety lamp to

make an inspection. As if to make sure of detecting firedamp if there was any, he took his naked light along with him. Unfortunately he did find firedamp, which is no respecter of persons when a naked light comes in contact with it, and he paid for his folly with his life.

The non-fatal explosions numbered 31, and resulted in the injury of 46 persons, including the five injured by the fatal explosion in Herbertshire Colliery already referred to. This result compares favourably with the preceding year, in which there were 42 explosions and 70 persons injured, but the number of these accidents is still far beyond what it ought to be. They all took place (except in the case of the Herbertshire explosion), where naked lights were in use, and as a large proportion was, as usual, due to disregard of the rules, it is evident that as the workmen and officials continue to ignore the regulations, it will be necessary to introduce safety lamps in all mines giving off firedamp, if explosions caused by open lights are to be prevented. In my last year's report, I drew attention to the fact that five-sixths of the whole number of prosecutions during the year were for contraventions of rules intended to prevent explosions of firedamp. During 1893 no fewer than 27 out of a total of 58 prosecutions were for contraventions of these same rules. Three months before the explosion in Herbertshire mine, no fewer than 17 of the workmen of that colliery were prosecuted at the same time for having pipes, matches, or contrivances for opening lamps in their possession in the mine. It will therefore be seen that there is much need of increased vigilance on the part of the officials in order that they not only observe the regulations themselves, but also that they enforce their observance by the workmen, and of the workmen voluntarily complying with the regulations so necessary for their own safety.

An explosion by which five men were injured happened in Viewpark No. 1 Pit, which was a new shaft being sunk. At the time of the explosion, the splint coal had just been passed through at a depth of 156 fathoms, and nine men were in the bottom, when a sudden outburst of gas occurred. Fortunately, it ignited at the naked lights before it had time to form an explosive mixture with the air, and when the kettle which was hanging 12 feet above the sinkers was lowered, they all got in and were drawn up out of danger of the burning gas. I was informed that on reaching the splint coal some gas was given off, and it ignited at a naked light. Instead of working with safety lamps while passing through the coal, as should have been done, the use of naked lights was continued, and resulted in what might have been an explosion of a much more serious nature.

Another explosion, by which three roadsmen were injured, took place in No. 10 Pit Enterkine, Ayr Colliery, and was caused by their being permitted by the fireman to go into an old road without it having been previously inspected. For failing to comply with General Rule 4, the fireman was prosecuted, and fined 2*l*.

Falls of roof and side.—There were 19 fatal accidents by falls, as against 27 the previous year, while the non-fatal similar accidents numbered 102, compared with 106 during the year 1892. Annexed are tables giving an analysis of the different kinds of these accidents in mines worked by the "stoop and room" and by the "long-wall" systems.

FATAL ACCIDENTS BY FALLS.

—	Number of Accidents in Mines worked "long-wall."	Number of Accidents in Mines worked "stoop and room."	Total Number of Accidents.
Falls of roof at working face -	7	3	10
" on roads - -	3	1	4
Falls of side at working face -	1	4	5
" on roads - -	—	—	—
Total - - -	11	8	19

NON-FATAL ACCIDENTS BY FALLS.

—	Number of Accidents in Mines worked "long-wall."	Number of Accidents in Mines worked "stoop and room."	Total Number of Accidents.
Falls of roof at working face -	30	15	45
" on roads - -	5	4	9
Falls of side at working face -	27	20	47
" on roads - -	1	—	1
Total - - -	63	39	102

The fatal falls of roof numbered 14, and there were 5 fatal falls of side, while there were 54 non-fatal accidents from falls of roof, and 48 from falls of side. Of the total number of 121 accidents by falls, 107 took place at the working face, and only 14 happened on the roadways. So far as prevention of accidents from falls on roadways is concerned, there does not seem to be the same urgent necessity for further steps being taken as is the case with regard to accidents at the working face. It is now becoming more generally recognised that in order to reduce the preventable loss of life and limb caused by falls of roof and sides at the working face, and which is admitted to be much higher than it ought to be, some method of systematic propping, by which a certain minimum fixed area of roof must in no case be left unsupported where the miners are at work, requires to be made compulsory. It is further necessary that holing sprags be set in all cases while the coal is being undercut, instead of this matter being left to the discretion of the workmen and officials as at present.

Last year 39 per cent. of the total number of fatal accidents in the kingdom were caused by falls, and in this district 43 per cent., while for the previous 20 years the average number of deaths by falls was 42 per cent. of the whole number of lives lost throughout the kingdom. There is no difficulty in getting the working places properly secured where the roof of a seam is well known to be bad, simply because if left unsupported it would be certain to give way, and accidents from falls of roof in such circumstances are comparatively of rare occurrence. On the other hand, where the roof is comparatively good, the danger is not so apparent, and the tendency is to omit or delay setting props because of the inconvenience caused to the miners, and it is under these circumstances that most accidents happen, either from a stone falling away from unseen "lipes" or joints, from a miscalculation of the true state of the roof, or from sheer neglect to take steps to secure a part of the roof which was known to be bad. If, therefore, props are set close to one another, and to the working face under bad roofs, there is no practical difficulty in the way to prevent them being similarly set under good roofs. The proof that such an apparently drastic measure is imperatively called for is the fact that so many accidents do take place through carelessness, and through unseen conditions of the roof which the most experienced of workmen or officials could not detect beforehand. Strict discipline and constant vigilance on the part of officials can do much to prevent accidents, but I am thoroughly convinced that this class of accidents will not be reduced in number as it might be until a General Rule is passed taking it out of the power of officials and workmen alike to set props at the working face when and where they choose. The Special Rules specify that besides being bound to prop and secure according to their own skill and experience, miners are required to place props, sprags, or holing props within their working places as the fireman, or other person authorised to that effect, shall deem necessary and shall direct. The matter is thus left in the hands of the miners, and of an official who, however competent and anxious to secure the safety of the workmen, does not prevent accidents which might be avoided, and who, moreover, is met on all sides by the extreme reluctance of the miners to set props where the roof is to all appearance safe. The adoption of compulsory systematic propping and spragging would free managers and their officials from much of the responsibility placed upon them of seeing that the roof and sides of working places are made secure in terms of General Rule 21, because they would simply require to see that a distinct and definite regulation was complied with in all cases, and only instruct that additional props be set where they considered it necessary. The miner also would only require to use his own judgment in setting props which were in addition to those prescribed by law, and I am confident that the result would be that a large proportion of the so-called "accidents that could not be prevented" would never take place.

Shaft Accidents.—The fatal accidents in shafts numbered 6, each of which resulted in the death of one person, while for the preceding year there were 5 similar accidents. The first of these happened at Bardykes Colliery, to the bottomer at a mid-working who had signalled for the cage, and while it had been raised to the "door heads" to enable him to put a hinged needle across the shaft for it to rest upon, he seems to have forgotten to signal it down again. The consequence was that he pushed a full hutch into the open shaft and fell after it a distance of 22 fathoms, and received injuries to which he afterwards succumbed.

The next happened at Orbiston Colliery to a pony driver, who was alone at the time, and in some unexplained manner fell from a mid-working. The third accident by falling from a mid-working took place at Abercorn No. 2 Pit, and befel the bottomer who expected one cage to be sent up to him from the low bottom, but as the engineman was at the time lowering men to the bottom in the other cage, the ascending cage did not stop at the mid-working. The bottomer evidently thought that the ascending cage had stopped, and he pushed a loaded hutch into the shaft, fell after it, and was killed. Two miners fell off the cage in an unexplained manner while ascending the shaft at Glenbuck and Daldowie Collieries, and the sixth fatal shaft accident was evidently caused by an unexploded dynamite charge

being drilled into in a sinking pit at East Parkhead Colliery. In this case it appears that the sinkers were intending to make use of part of an old shot-hole, and two of them were about to drill it deeper with a jumper. The deceased held the jumper, while the other struck it with the hammer, when a violent explosion took place, killing one and injuring the other. So far as I could learn, no one knew that any previous shots, several of which were fired at once, had failed to go off.

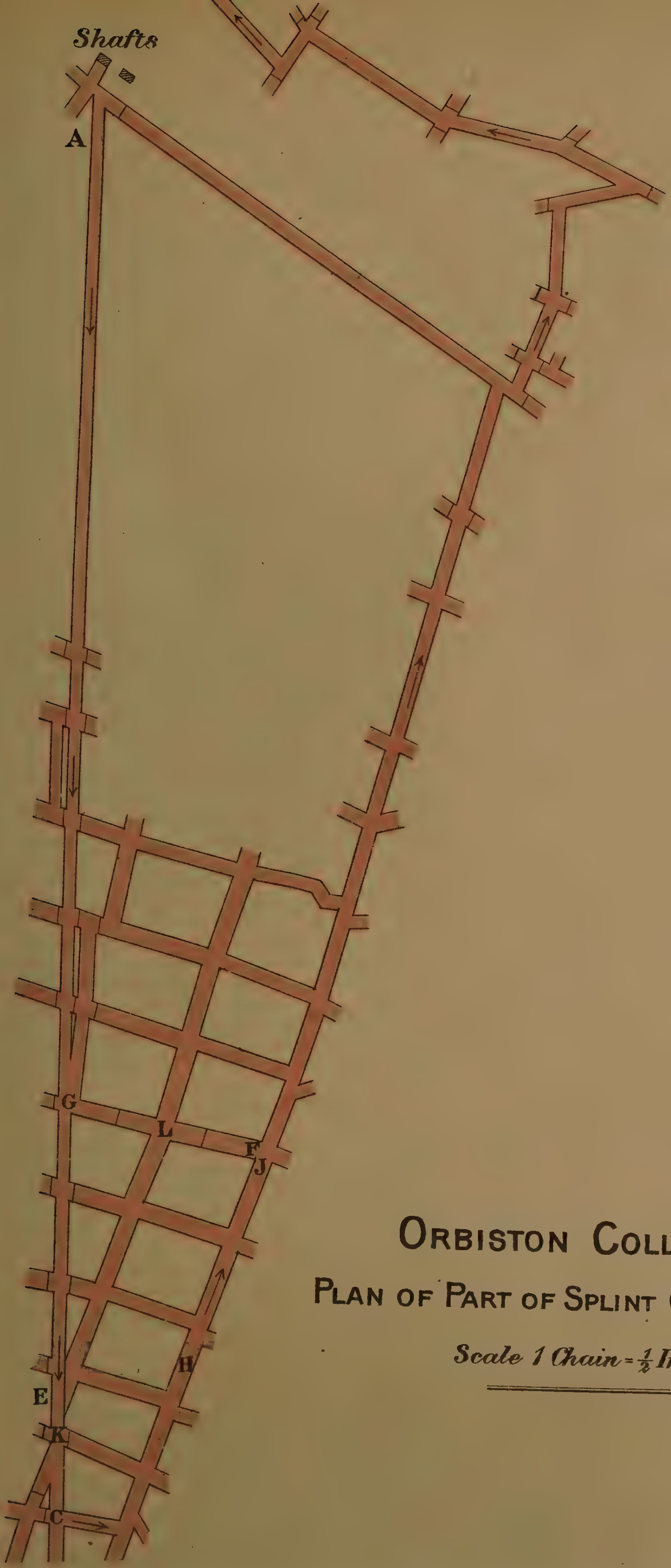
The non-fatal accidents in shafts numbered 13, and by them 14 persons were injured.

Miscellaneous accidents underground.—These accidents which ended fatally numbered eight, as compared with 19 the previous year, and resulted in the death of 10 persons. One man lost his life by a shot hanging fire, and by its going off just as he returned to it without having allowed the prescribed half hour to elapse. Two persons were killed by kicks from horses, one pony driver was run over by hutches, a drawer was crushed by a hutch while supposed to have been drawing in front of it, a haulage man was killed by runaway hutches on a dook, and an overman, while attempting to pass a bell crank in motion, was caught and killed. The most serious accident happened at Orbiston Colliery, through an underground fire, and by it three men lost their lives.

Referring to the accompanying plan of the part of the splint coal workings of Nos. 1 and 2 Pits, A B is a dook extending from the pit bottom to a distance of 300 yards to the dip. No working operations except pumping water had been carried on in this dook for some time. A pump placed near the foot of the dook discharged the water at the top, the pump being worked by wooden pump rods connected to the rods in the shaft and carried down the road A B on pulleys. These pump rods were of red pine, having an iron plate fixed beneath the parts running on the rollers, which were of iron, 7 inches in diameter. The length of the pump stroke was 3 feet 9 inches, and the speed of working was about six strokes per minute. The air circulating in these workings, and stated by the manager to be about 4,000 cubic feet per minute, went in the direction shown by the arrows.

It appears that shortly before midnight on the 26th of May the plunger casing of the shaft pump in the Splint Coal broke, and when this was discovered two men were sent down the dook to open a stop-cock on the discharge column of pipes at the point C, to run water taken down a bore hole from the Ell Coal at D into the Splint Coal lodgment. When about half way down the dook they were met by smoke, and on going farther down to the point E, they they saw the pump rods on fire, whereupon they returned and reported what they had discovered. Under the directions of the under manager, proceedings were at once taken to extinguish the fire, which was found to be of comparatively trifling extent, being confined to a pump rod, two or three props, and some loose coal which had fallen off the side of the road. Four men named James Smith, John McKillop, William Maddison and R. Chisholm, went down the dook past the fire and broke a joint in the discharge column of pipes some 6 yards below the fire, with the intention of obtaining water, but were unable to force the pipes apart. They next went up past the fire, and again returned to where they had broken the joint, and sat down to wait until pails were brought down to them, as they meant to carry water from the stop-cock at C. The fumes off the fire were not bad at first, but the smoke went up the dook against the air current, while below the fire the air seemed much clearer and the lamps burned well. One of these men, James Smith, stated that after waiting some time he and John McKillop began to feel giddy, and getting alarmed, he wanted the others to accompany him out the return airway C H, and out by F G to the dook above the fire, but they remained where they were, and he went alone, but was overcome by the fumes, and was afterwards found insensible at the point J. Meanwhile, other men went by the road G F H C, and found McKillop and McAllister at K. McAllister was carried out the way they came, but died shortly after the fresh air was reached at G. Andrew Muir and Maddison tried to follow with McKillop, but feeling themselves being overcome, they had to leave him and crawl out by the road C H. Maddison was afterwards found dead at F, and Muir insensible at E. McKillop's body was found at K, but was not taken out until 10 a.m., after the fire had been extinguished. This was done under the superintendence of Mr. D. M. Mowatt, the manager, who reached the colliery at 5.30 a.m. By forcing more air down the dook, the workmen were enabled to get to the fire where, after drilling holes in the discharge pipe, they got a supply of water, and had no difficulty in getting the fire put out.

This accident probably would not have happened had the fire been of a more serious nature. No one at first thought there was any danger, as the men were able to enter the return airway with seeming impunity, and the lamps throughout continued to burn, one having been found burning beside the body of McKillop when it was taken out. The fatal consequences seem to have resulted from the imperfect combustion forming carbonic oxide



Orbiston Colliery

Plan of Part of Splint Coal Workings.

Scale 1 Chain = ½ Inch.

gas which is of a very poisonous nature, but does not extinguish a lamp as does carbonic acid gas.

The origin of this fire is a matter of uncertainty. It was stated by one of the men who discovered it that the burning pump rod was covered by pieces of coal that had evidently fallen off the side of the road. It is therefore not unlikely that this coal fell and that the heat generated by the rods rubbing on it was sufficient to cause the fire to break out. It appears that no one had been down the Splint Dook for six days previous to the discovery of the fire, the practice being for a man to go down to grease the pump rods and look at the pump only once a week. By General Rule 5 and Special Rule 38 it is required that the roadsmen once at least in every 24 hours shall examine the state of the external parts of the machinery in actual use below ground. It was therefore the duty of the manager to have appointed a competent person to make a daily inspection of the whole of the pumping machinery, and if the fire originated in the manner referred to, it is probable that had the prescribed inspection been made, the rubbing of the pump rods on the coal would have been detected in time and the fatal consequences of the fire would not have followed.

The non-fatal miscellaneous accidents underground numbered 61, resulting in the injury of 64 persons, as compared with 67 accidents and 75 persons injured the previous year.

Accidents above ground.—There were seven fatal accidents on the surface during the year, including one which happened on a private branch railway. The first of these occurred to an engineman who was winding water. In some unexplained manner he lost control of the engine, and just as the chest of water was drawn over the pithead frame he unfortunately ran out of the engine-house door to the spot where the water chest fell and was killed by it. The next also happened to an engineman who was cleaning the fly-wheel of the winding engine which was in close proximity to the tumbling crank of the pumping engine, and while thus engaged he was caught by the crank. There was no occasion whatever for him going near the moving crank, as he could have moved the fly-wheel and cleaned it all from a point of safety. A "screeman" fell off a waggon and was run over by it; a locomotive assistant was supposed to have fallen while attempting to jump on the buffer of a waggon, and was run over, and a waggoner, after putting a sprag in a wheel of a waggon at rest, was knocked in front of the wheels by the sprag, when another waggon struck the waggon at rest and set it in motion. While unloading a heavy oil tank from a railway waggon, a store keeper was killed by the tank falling upon him, and a pony having run away with a hutch of ashes, the driver fell and was run over.

The non-fatal surface accidents numbered 24, by each of which one person was injured.

In addition to accidents comprised under the Coal Mines Regulation Act, notice was sent me of a case of suicide on New Year's Day by a man jumping down a shaft, of two cases of death in the mine from natural causes, of a platelayer in the employment of the Caledonian Railway Company being killed by a waggon near the screens at a colliery, and of the death of a boy not employed at the mine who was amusing himself by riding on a waggon which he set in motion when it ran into some loaded waggons. I also received notice of seven non-fatal surface accidents to persons not employed at the mine.

PROSECUTIONS.

The prosecutions during the year numbered 58, of which 22 were either at my instance or by the Procurators Fiscal, and 36 by the Procurators Fiscal from information laid by owners or managers. The following are lists of these prosecutions, No. 1 list being taken at my instance or by the Procurator Fiscal, and No. 2 list being cases taken by the owners:—

No. 1 LIST.

Name, Occupation, and Mine.	Place of Hearing and Date.	Contraventions.	Result of Trial.
Lawrence H. Watson, trustee, Stonelaw Colliery.	Glasgow, 19th January	Sec. 16 (1) (*b*).—Failing to have a proper second outlet. General Rule 1.—Inadequate ventilation.	Acquitted.
Robert Angus, owner, Knockterra Colliery.	Ayr, 24th January	Sec. 21 and 22.—Failing to have daily supervision of manager, or eligible under manager.	Fined 1*s*.
Jas. McNeil, manager, Belhaven Colliery.	Hamilton, 10th Feb.	Sec. 35 (1) (i.)—Failing to send notice of explosions of firedamp.	Fined 2*l*.
Daniel Gilmour, manager, Portland Colliery.	Kilmarnock, 13th Feb.	General Rule 1. — Inadequate ventilation. Special Rule 2.—Failing to see that the quantity of air was recorded.	Fined 2*l*. 10*s*. for each offence.
Wm. White, fireman, Souterhouse Colliery.	Airdrie, 13th Feb.	General Rule 4.—Delaying to report in the book the presence of gas.	Fined 2*l*.
James Paterson, fireman, Gilbertfield Colliery.	Hamilton, 21st Feb.	General Rule 12 (*f*).—Allowing brushers to fire shots, and failing to make an inspection before they were fired.	Fined 1*l*.

Name, Occupation, and Mine.	Place of Hearing and Date.	Contraventions.	Result of Trial.
George Gavin, fireman, Dalziel Colliery.	Hamilton, 21st Feb. -	Special Rule 38.—Failing to clear out gas before admitting workmen.	Fined 1*l.*
David Cunningham, fireman, Carfin Colliery.	Hamilton, 21st April -	Ditto ditto	Fined 1*l.*
Andrew Jeffrey, manager, Carfin Colliery.	Hamilton, 2nd May -	Sec. 16 (1) (*b*).—Failing to have a proper second outlet. General Rule 1.—Inadequate ventilation.	Fined 5*l.*
John Love, manager, Loudoun Colliery.	Kilmarnock, 8th May	General Rule 1.—Inadequate ventilation.	Fined 5*l.*
Ditto ditto	Ditto	General Rule 14.—Failing to have manholes.	Fined 5*s.*
Gilbert Stewart, agent, Loudoun Colliery.	Ditto	General Rule 1.—Inadequate ventilation.	Not proven.
Robert Pettigrew, owner, Souterhouse Colliery.	Airdrie, 8th Sept. -	Sec. 16 (1) (*b*).—Failing to have communication of prescribed dimensions.	Fined 5*l.*
Daniel Smith, manager, Souterhouse Colliery.	Ditto	Ditto ditto	Fined 5*l.*
Walter K. Wood, agent, Broomhouse Colliery.	Airdrie, 26th October	General Rule 1.—Inadequate ventilation.	Fined 10*l.*
Henry Frew, manager, Broomhouse Colliery.	Ditto	Ditto ditto	Fined 10*l.*
Ditto ditto	Ditto	General Rule 14.—Failing to provide manholes.	Fined 5*l.*
Walter K. Wood, agent - -	Ditto	Ditto ditto	Fined 5*l.*
Andrew Hunter, fireman, Souterhouse Colliery.	Ditto	General Rule 4.—Failing to inspect part of the workings.	Fined 2*l.*
Hugh Strain, agent, Heatheryknowe, No. 3 Pit.	Airdrie, 20th Nov. -	General Rule 1.—Failiure to see that adequate ventilation was provided.	Fined 20*l.*
Adam Todd, manager, Heatheryknowe, No. 3 Pit.	Ditto	General Rule 1.—Failure to provide adequate ventilation.	Fined 2*l.*
John Herbertson, miner, Ballochmyle Colliery.	Ayr, 20th December -	General Rule 22.—Failing to set sprags.	Fined 30*s.*
John Lowrie, fireman, Ayr, No. 10 Pit, Enterkine.	Ditto	General Rule 4.—Failing to inspect a road where men were about to work.	Fined 2*l.*

LIST No. 2.

Name, Occupation, and Mine.	Place of Hearing and Date.	Contraventions.	Result of Trial.
Patrick Graham, drawer, Herbertshire, No. 3 Pit.	Stirling, 10th January	General Rule 10 (ii.) and (iii.).—Unlocking his safety lamp.	Fined 1*l.*
John Morton, brusher, Gartshore, No. 3 Pit.	Dumbarton, 27th Jan.	General Rule 12 (*f*).—Illegally firing a shot -	Fined 1*l.*
David Clements, miner, Govan Colliery.	Glasgow, 8th Feb. -	General Rule 22.—Failing to set enough of sprags.	Fined 1*l.*
James Black, miner, Govan Colliery.	Ditto	Ditto ditto	Fined 1*l.*
Seventeen miners, &c. Herbertshire, No. 3 Pit.	Stirling, 29th March -	Special Rule 87 (3), (4) and (6).—Having pipes, matches, &c. in the mine.	Fined 10*s.* each.
James McNulty, miner, Lanemark, No. 2 Pit.	Ayr, 11th April - -	General Rule 12 (*b*).—Taking loose powder into the mine.	Fined 30*s.*
Thomas Brown, miner, Broomhouse Pit.	Airdrie, 12th April -	Special Rules 73 and 74.—Failing to set sprags.	Fined 1*l.*
W. Abercrombie, miner, Nethercroy, No. 1 Pit.	Dumbarton, 12th Apr.	Special Rule 87 (6).—Smoking in the mine -	Fined 2*l.*
Peter Docherty, miner, Nethercroy, No. 1 Pit.	Ditto	Ditto ditto	Fined 1*l.*
W. Mitchell, engineman, Dalziel, No. 3 Pit.	Hamilton, 21st April -	Special Rules 20 and 21.—Leaving his engine while men were in the mine.	Fined 2*l.*
James Hughes, miner, Quarter Colliery.	Stirling, 2nd May -	Special Rule 87 (6).—Smoking in the mine -	Fined 1*l.*
James Robertson, miner, Gartshore, No. 9 Pit.	Dumbarton, 12th May	Special Rule 87 (3) and (4).—Having a contrivance for unlocking a lamp, and striking a light.	Fined 1*l.*
James Lennon, miner, Tannochside Colliery.	Airdrie, 20th May -	Special Rules 73 and 74.—Failing to set sprags.	Fined 10*s.*
Thomas Earlie, miner, Gartshore, No. 3 Pit.	Dumbarton, 22nd May	Special Rule 87 (6).—Smoking in the mine -	Fined 1*l.*
John Williamson, miner, Bank Colliery.	Ayr, May -	Special Rule 12 (*b*).—Taking loose powder into the mine.	Fined 2*l.*
Henry Cunningham, pony driver, Tannochside, No. 2 Pit.	Airdrie, 28th July -	General Rule 8.—Using a naked light where safety lamps were required.	Fined 10*s.*
John Dempsey, miner, Hallside -	Hamilton, 22nd Aug.	Special Rule 87 (6).—Having a pipe in his possession.	Fined 1*l.*
John Lang, miner, Herbertshire, No. 3 Pit.	Stirling, 26th August	Special Rule 87 (2) and (3).—Unlocking a safety lamp and possessing a key.	Fined 30*s.*
L. Jackson, miner, Parkhead Colliery.	Hamilton, 12th Sept. -	General Rule 12 (*b*).—Taking loose powder into the mine.	Fined 2*l.*
James Freel, miner, Hallside Colliery.	Ditto	Special Rule 87 (4) and (6).—Having a pipe and matches in his possession.	Fined 1*l.*
Michael Queen, miner, Hallside Colliery.	Ditto	Special Rule 87 (6).—Having a pipe in his possession.	Fined 1*l.*
John Mellon, miner, Hallside Colliery.	Ditto	Special Rule 87 (4).—Having matches in his possession.	Fined 15*s.*

Name, Occupation, and Mine.	Place of Hearing and Date.	Contraventions.	Result of Trial.
John Forrest, miner, Barrwood, No. 2 Pit.	Stirling, 2nd October -	Special Rule 87 (6).—Smoking in the mine -	Fined 2*l.*
Alexander Dunion, miner, Quarter Colliery.	Ditto	Ditto ditto	Fined 2*l.*
James Cassidy, brakesman, Dechmont Colliery.	Hamilton, 6th October	Special Rule 87 (4).—Having matches in his possession.	Fined 30*s.*
John Burnett, roadsman, Dechmont Colliery.	Ditto	Ditto ditto	Fined 30*s.*
John Glancy, miner, Tannochside Colliery.	Airdrie, 1st September	Special Rule 87 (5).—Using a naked light where safety lamps were required.	Fined 30*s.*
Alexander Laird, rusher, Herbertshire, No. 3 Pit.	Stirling, 17th October	Special Rule 87 (2) and (3).—Opening a safety lamp and possessing a key.	Fined 2*l.*
Gavin Wilson, miner, Abercorn, No. 2 Pit.	Paisley, 31st October	General Rule 12 (*b*).—Taking loose powder into the mine.	Fined 30*s.*
Ludovick Barrie, miner, Dumbreck, No. 1 Pit.	Stirling, 9th Nov. -	Special Rule 87 (6).—Smoking in the mine -	Fined 2*l.*
James Ryan, miner, Govan, No. 6 Pit.	Glasgow, 10th Nov. -	Special Rules 73 and 74.—Failing to set sprags as directed.	Fined 30*s.*
Hugh Harrigan, miner, Caldwell Mine.	Kilmarnock, 17th Nov.	General Rule 12 (*d*).—Having an iron stemmer in his possession.	Fined 5*s.*
Patrick McGuigan, miner, Caldwell Mine.	Ditto	Ditto ditto	Fined 5*s.*
John McCaig, miner, Abercorn, No. 2 Pit.	Paisley, 28th Nov. -	General Rule 12 (*b*).—Taking loose powder into the mine.	Fined 30*s.*
John Brady, miner, Quarter Colliery	Stirling, 14th Dec. -	Special Rule 72.—Riding on a hutch without permission.	Fined 1*l.*
James Brady, miner, Quarter Colliery.	Ditto	Ditto ditto	Fined 1*l.*

Examination for Managers' Certificates.

The annual examination of candidates for managers' and under managers' certificates of competency was as usual held in Glasgow on the 24th and 25th of November. The number who presented themselves for examination for first class certificates was 51, of whom 17 succeeded in passing, while for second class certificates there were 40 applicants, of whom 23 were successful.

Exemptions.

The following exemptions from the requirements of the Coal Mines Regulation Act were granted by the Secretary of State during the year:—

Stonelaw Colliery.—Exemption for four months from the provisions prohibiting single shafts while an outlet is being made, under section 18 (iii.) (*a*).

Caprington Colliery, Nos. 37 and 40 pits.—Exemption under section 18 (ii.) (*b*) from the provisions prohibiting single shafts, on account of the workings having reached the extremity of the field.

Busbiehead Colliery.—Exemption under General Rule 12 from the regulation as to cartridges.

Stonelaw Colliery.—An extension of 2½ months time to the exemption previously granted under section 18 (iii.) (*a*).

Fairlie Colliery.—Exemption for 5½ months under section 18 (iii.) (*a*) from the provisions prohibiting single shafts while an outlet is being made.

Glengyron Colliery.—Exemption for four months under section 18 (iii.) (*b*) from the provisions prohibiting single shafts on account of an accident to one of the shafts.

Complaints.

The complaints, anonymous and otherwise, have been more numerous than usual during the year. The great majority of these have been in connexion with the weighing of coal, or deductions for stones put out along with the coal. To show the variety of this kind of complaint I give the following examples:—Want of facilities given to the check weigher such as want of a desk to place his slate, no protection from the weather, insufficient light to see the hutches weighed, danger of being run over by hutches while seeing them weighed, want of facilities to tare hutches, and refusal of pitheadman to weigh correctly. One common cause of complaint has been that the owners, instead of giving the miners credit for the whole contents of the hutches, have insisted on making no allowance for any weight which does not amount to a full half cwt. Thus, if a hutch weighed 10 cwts. 50 lbs., the 50 lbs. would in all cases be deducted. Such a practice is manifestly unjust, as well as illegal, and although in one sense the injustice may not be apparent, seeing that wages may have been adjusted on this basis, this comparatively trifling matter has been the source of a great deal of unnecessary irritation on the part of the miners against the mine owners.

With reference to the practice of making a uniform deduction from every hutch of coal as an equivalent for dirt or stones, irrespective of the actual weight of stones which it may contain, following complaints made, and in accordance with your instructions, I took proceedings against the manager of Orbiston Colliery to test the legality of this practice. At this colliery a uniform deduction of half a cwt. is made from each hutch of coal. On 25th of October last four hutches were taken at random as they came up the pit, and all the foreign material it was possible to pick out by hand was separated, no account being taken of any dirt contained in the small coal which passed through a riddle with a half-inch mesh. The weight of dirt thus ascertained weighed 5, 8, 23, and 36 lbs. in the respective hutches. After a trial lasting two whole days the sheriff substitute, following the recent decision in the appeal case of Kearney *v.* Whitehaven Colliery Company, found the charges proved, and imposed a fine of 2*l.* Notice of appeal against this decision has been given, and the case will shortly be brought before the higher court.

Inspection Duties.

Throughout the year I have been assisted by Mr. T. H. Mottram and Mr. Andrew Pearson, who have both ably and willingly given every assistance that was required of them in seeing the provisions of the Mines Regulation Acts carried out. Personally I was officially engaged on 297 days, making underground inspections on 109 days, and above-ground inspections on 137 days, while office work, prosecutions, and attendance at the Home Office, took up the other 51 days. Mr. Mottram made underground inspections on 223 days, was occupied 33 days with inspections aboveground, and on 41 days was engaged with office work and prosecutions. Mr. Pearson made underground inspections on 219 days, surface inspections on 27 days, and was engaged with office work and prosecutions on 41 days.

As usual, all accidents reported and complaints made have been investigated. Every mine at work throughout the year, with the exception of five small collieries, has had at least one underground inspection more or less complete made of it.

Mines worked under the Metalliferous Mines Regulation Act.

The following tables give the number of persons employed in and about these mines, and the quantity of minerals raised therefrom :—

Persons employed.

Year.	Underground.			Above Ground.			Total above and below Ground.
	Males.			Males.			
	Ages 13 to 16.	Ages above 16.	Total.	Ages 13 to 18.	Ages above 18.	Total.	
1893 - -	2	158	160	25	103	128	288
1892 - -	4	194	198	33	92	125	323

Tons of Minerals raised.

Year.	Lead Ore.	Zinc Ore.	Ganister.	Building Stone.	Limestone.	Hone.	Total.
1893 - - -	1,870	140	286	5,500	3,252	336	11,384
1892 - - -	2,025	128	275	10,731	1,140	341	14,640

No accidents were reported during the year from any of the mines.

I enclose—

(1.) The formal reports under the Metalliferous Mines Regulation Acts of the Inspectors assisting.

(2.) List of the fatal accidents, arranged in counties, reported from mines worked under the Coal Mines Regulation Act.

I have, &c.,
J. M. RONALDSON.

The Right Hon. H. H. Asquith, Q.C., M.P.,
Her Majesty's Principal Secretary of State,
Home Department, Whitehall.

Reports of Assistant Inspectors.

4, Melrose Gardens, Glasgow, W.
12th March 1894.

SIR,

I HAVE the honour to report, in accordance with section 20 of the Metalliferous Mines Act, 1872, that during last year I exercised the duties of an Inspector of Mines in the West of Scotland District, and that in doing so I acted as assistant to and under the direction of Mr. John M. Ronaldson, the Inspector in charge of the district.

I have, &c.

THOMAS HARRY MOTTRAM.

The Right Hon. Herbert H. Asquith, Q.C., M.P.,
Her Majesty's Principal Secretary of State,
Home Office, Whitehall.

Stonelaw Cottage, Rutherglen, Glasgow,
19th February 1894.

SIR,

I HAVE the honour to report to you, in pursuance of section 20 of the Metalliferous Mines Regulation Act, 1872, that during the past year I exercised the duties of Inspector of Mines in the West District of Scotland, and that in doing so I acted as assistant to and under the direction of Mr. J. M. Ronaldson, the Chief Inspector for that district.

I have, &c.

ANDREW PEARSON.

The Right Hon. Herbert H. Asquith, Q.C., M.P.,
Her Majesty's Principal Secretary of State,
Home Office, Whitehall.

COAL MINES REGULATION ACT.

LIST of the FATAL ACCIDENTS, and DEATHS arising therefrom, within one year and a day from the date of the Accident, during the Year 1893.

Date and Hour of the Accident.	Hour of the Person's Shift, *i.e.*, number of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	No. of Lives lost: Explosions of Firedamp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.
					AYRSHIRE.								
Feb. 13 2.30 p.m.	1st	Jellieston - -	Dalmellington	Dalmellington Iron Co. -	Jas. McConnel -	55	Brusher -	Fall of roof on road while brushing it	–	1	–	–	–
Mar. 12 1.0 p.m.	6th	Corby Craigs, No. 4.	Ditto -	Ditto -	Alexr. Gourlay -	—	Engineman	Struck by tumbling crank of pumping engine.	–	–	–	–	1
Mar. 16. 8.30 p.m.	3rd	Springhill, No. 4.	Dreghorn -	Archd. Finnie and Son -	Wm. Brown -	14	Drawer -	Crushed by a hutch, which he was taking down a heading.	–	–	–	1	–
Apr. 24 4.15 p.m.	10th	Glenbuck, Davie Pit.	Muirkirk -	Cairntable Gas Coal Co. -	Andrew Wood -	22	Miner -	Fell from the cage whilst ascending	–	–	1	–	–
June 1 7.0 a.m.	1st	Portland, No. 4. -	Kilmarnock -	Portland Colliery Co. -	Gilbert Wilson -	53	Overman -	Caught by a bell crank while attempting to pass it.	–	–	–	1	–
July 5 2.30 pm.	8th	Gilmilnscroft, No. 4.	Auchinleck -	Gauchalland Coal Co. -	Hugh Hannah -	35	Miner -	Fall of roof at brushing face -	–	1	–	–	–
Oct. 16 1.45 p.m.	7th	Glenbuck, Galawhistle Pit.	Muirkirk -	Cairntable Gas Coal Co. -	Wm. Bertram -	29	Ditto -	Fall of coal - - -	–	1	–	–	–
Dec. 11. 5.0 p.m.	1st	Auldhouseburn, Bankhead Pit	Ditto -	Ditto -	Richd. Murray -	25	Ditto -	Ditto - - - -	–	1	–	–	–
Dec. 25 3.45 p.m.	10th	Goatfoot - -	Galston -	Brand & Co. - -	John Hastings -	19	Chainrunner	Kicked by a pony - - -	–	–	–	1	–
					DUMFRIESSHIRE.								
Feb. 13 11.55a.m.	5th	Sanquhar - Gateside Pit.	Sanquhar -	J. J. McConnell - -	Robert Duff -	32	Engineman	He overwound a chest of water, which fell on him.	–	–	–	–	1

List of the Fatal Accidents, &c.—*continued.*

Date and Hour of the Accident.	Hour of the Person's Shift, i.e., number of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	No. of Lives lost. Explosions of Firedamp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.
					LANARKSHIRE.								
Jan. 14 9.0 a.m.	5th	Orbiston, Nos. 1 & 2.	Bellshill	Summerlee and Mossend Iron and Steel Co.	Matthew Busby	51	Miner	Fall of roof at working face	—	1	—	—	—
Jan. 18 1.30 p.m.	6th	Tannochside, No. 1.	Uddingston	Calderbank Steel and Coal Co.	Jas. Hutchieson	40	Ditto	Ditto	—	1	—	—	—
Feb. 9 11.0 a.m.	6th	Bardykes	Newton	Merry and Cuninghame	Wm. Reid	21	Bottomer	Pushed a hutch into the shaft at a mid-working, and fell with it 22 fathoms.	—	—	1	—	—
Feb. 15 9.0 am.	3rd	Kirkwood, No. 1	Coatbridge	Kirkwood Coal Co.	Joseph Findlay	19	Bogieman	Struck by runaway hutches on a dook.	—	—	—	1	—
Feb. 20 5.0 a.m.	8th	Bothwell Park, No. 1.	Bothwell	Wm. Baird & Co.	Hugh Boyce	44	Repairer	Fall of roof on old road	—	1	—	—	—
Feb. 27 2.0 a.m.	4th	Shields, No. 1	Motherwell	Jas. Wood	Francis Stewart	44	Miner	Fall of coal while "stooping"	—	1	—	—	—
Feb. 28 4.0 p.m.	10th	Orbiston, Nos. 1 & 2.	Bellshill	Summerlee and Mossend Iron and Steel Co.	Gecrge Cameron	17	Pony driver	Fell down the shaft from a mid-working.	—	—	1	—	—
Mar. 1 11.0 a.m.	4th	Gateside, No. 1	Cambuslang	Flemington Coal Co.	Alexr. Laird	50	Miner	Fall of roof at working face while "stooping."	—	1	—	—	—
Mar. 20 11.15 a.m.	5th	Hamilton Palace	Bothwell	Bent Colliery Co.	Thomas Connolly	47	Screenman	Fell off a waggon in motion and was run over.	—	—	—	—	1
Apr. 11 5.0 p.m.	11th	Heathery Knowe	Baillieston	Ferrier and Strain	Alexr. Swan	—	Engineman	Fall of roof on road	—	1	—	—	—
Apr. 21 12.20 a.m.	2nd	Cadder, No. 16.	Bishopbriggs	Carron Co.	Wm. Taylor	52	Miner	Fall of roof at working face	—	1	—	—	—
Apr. 27	1st	Gilbertfield, No. 2.	Cambuslang	Cambuslang Coal Co.	Patrick McNamee	20	Ditto	Fall of coal	—	1	—	—	—
May 1 6.30 a.m.	1st	Govan, No. 6	Glasgow	Wm. Dixon (Limited)	Ed. Milligan	50	Ditto	Ignition of a shot which had not gone off, and to which he returned too soon, and while lighting another squib.	—	—	—	1	—

List of the Fatal Accidents, &c.—*continued.*

Date and Hour of the Accident.	Hour of the Person's Shift, *i.e.*, number of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	No of Lives lost. Explosions of Firedamp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.
				LANARKSHIRE—*continued.*									
May 13 noon	7th	Daldowie	Mount Vernon	Dunn Brothers	George Harper	48	Miner	Fell off cage while ascending the shaft.	–	–	1	–	–
May 19 7.0 p.m.	1st	Govan, No. 5	Glasgow	Wm. Dixon (Limited)	Edward Gillespie	45	Brusher	Fall of roof at brushing face	–	1	–	–	–
May 27 2.0 a.m.	3rd	Orbiston, Nos. 1 & 2.	Bellshill	Summerlee and Mossend Iron and Steel Co.	Peter McAllister John McKillop Wm. Maddison	44 50 30	Roadsman Ditto Ditto	Overcome by fumes while extinguishing an underground fire.	–	–	–	3	–
June 19 5.15 p.m.	11th	Douglas Park, No. 1.	Ditto	Wilsons and Clyde Coal Co.	Jas. McGeoch	27	Miner	Fall of roof at stoops while taking out props.	–	1	–	–	–
June 30 7.30 a.m.	2nd	Rosehall, No. 12	Coatbridge	Robt. Addie and Sons	Wm. Wyllie	40	Ditto	Fall of roof at brushing face	–	1	–	–	–
Aug. 9. noon	5th	Blackhill, No. 9	Maryhill	Summerlee and Mossend Iron and Steel Co.	John Taylor	14	Pony driver	Pony ran away with a hutch of ashes, and he fell, being run over.	–	–	–	–	1
Aug. 16 8.0 p.m.	2nd	Hattonrig, No. 3.	Bellshill	Ditto	Edward Fee	60	Fireman	Explosion of firedamp while inspecting with an open light.	1	–	–	–	–
Aug. 18 9.0 a.m.	3rd	Glenclelland, No. 1.	Motherwell	Kerr and Mitchell	Wm. McIver	41	Miner	Fall of coal and shale from working face.	–	1	–	–	–
Aug. 22 2.0 p.m.	7th	North Motherwell No. 1.	Ditto	Merry and Cuninghame	Robert Paterson	35	Pony driver	Run over by a hutch, after falling in front of it.	–	–	–	1	–
Aug. 22 4.0 p.m.	6th	East Parkhead, No. 2.	Bellshill	Wilsons and Clyde Coal Co.	Pat. O'Donnel	45	Sinker	Explosion of dynamite, supposed to have been caused by a drill striking an unexploded shot.	–	–	1	–	–
Aug. 22 1.0 p.m.	7th	Cleland, No. 40	Holytown	Ravenshall Coal Co.	James Small	28	Drawer	Kicked by a pony	–	–	–	1	–
Aug. 25 6.30 p.m.	12th	Shields, No. 1	Motherwell	Jas. Wood (Limited)	Adam Dewar	18	Waggoner	Run over by a waggon after spragging it.	–	–	–	–	1
Oct. 7. 7.30 a.m.	2nd	Daldowie	Mount Vernon	Dunn, Brothers	Robt. Miller	35	Storekeeper	Crushed by a tank, which fell while being disloaded.	–	–	–	–	1
Oct. 10 10.0 a.m.	4th	Tannochside, No. 1.	Uddingston	Calderbank Steel and Coal Co.	John Graham	33	Miner	Fall of roof at working face	–	1	–	–	–

List of the Fatal Accidents, &c.—*continued.*

Date and Hour of the Accident.	Hour of the Person's Shift, *i.e.*, number of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	No. of Lives lost. Explosions of Firedamp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.
				LANARKSHIRE—*continued.*									
Oct. 10 11.0 p.m.	1st	Blackhill, No. 9 -	Maryhill -	Summerlee and Mossend Iron and Steel Co.	Henry Docherty -	57	Miner -	Fall of roof on haulage road while repairing it.	–	1	–	–	–
Oct. 13 6.30 a.m.	1st	Thankerton -	Holytown -	John McAndrew & Co. -	Robt. Young O'Brien.	—	Locomotive assistant.	Run over by waggons. Supposed to have fallen while jumping on front buffer.	–	–	–	–	1
Nov. 21 12.30 p.m.	7th	Stonelaw, No. 3 -	Rutherglen -	The Farme Coal Co. -	Jas. Samson -	36	Miner -	Fall of roof at working face -	–	1	–	–	–
				RENFREWSHIRE.									
Dec. 5 7.20 a.m.	2nd	Abercorn, No. 2 -	Paisley -	Merry and Cuninghame -	Peter McConnel -	57	Bottomer -	Fell from a mid-working - -	–	–	1	–	–
				STIRLINGSHIRE.									
June 30 2.30 p.m.	8th	Herbertshire, No. 3.	Denny -	Robert Addie and Sons -	Jos. Robertson - Lovel Thursbay -	27 14	Miner - Ditto -	Explosion of firedamp, caused by a miner opening his safety lamp.	2	–	–	–	–
									3	19	6	10	7

REPORTS

OF

JOSEPH S. MARTIN, Esq., H.M. INSPECTOR OF MINES

FOR THE

SOUTH-WESTERN DISTRICT (No. 12),

(COMPRISING WHAT WERE FORMERLY Nos. 12 AND 14 DISTRICTS),

TO

HER MAJESTY'S SECRETARY OF STATE,

UNDER

The Coal Mines Regulation Act, 1887, the Metalliferous Mines Regulation Acts, 1872 and 1875, and the Slate Mines (Gunpowder) Act, 1882;

For the Year 1893.

Presented to both Houses of Parliament by Command of Her Majesty.

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Mr. Martin's Report.

REPORT of the INSPECTION of MINES under the COAL MINES REGULATION ACT, 1887, in the SOUTH-WESTERN (No. 12) DISTRICT, comprising the counties of CORNWALL, DEVON, DORSET, GLOUCESTER, HANTS, ISLE OF WIGHT, HEREFORD, MONMOUTH, SOMERSET, WILTS, and parts of BRECON and GLAMORGAN, for the Year 1893.—By JOSEPH S. MARTIN, Esq.

SIR, Durdham Park, Bristol, 10th March 1894.

In accordance with Section 43 of the Coal Mines Regulation Act, 1887, I have the honour as Inspector of Mines in charge of the South-Western Mining District to submit the following report, with reference to the working of the Act in this district, and such other matters as appears to me to be of interest during the year ending 31st December 1893.

I have again had the advantage of Mr. Bain's experience and intimate knowledge of the district, and also the assistance of Mr. E. E. V. Stokes in carrying out my duties.

Inasmuch as I have charge of the district under both this Act and the Metalliferous Mines Regulation Act, 1872, and in view of the importance of each class of mines in this district, I purpose, as I did last year, keeping my reports under the two Acts entirely separate, and here to deal only with matters under the Coal Mines Act.

I have no reason to report otherwise than that the Act has worked smoothly, but I regret that during the latter half of the year the number of fatal accidents very largely exceeded that of the first half. I have been unable to fix upon any definite cause, although in some cases laxity in fulfilling the requirements probably contributed to accidents, but I hope that by here drawing attention thereto the managers will improve supervision and discipline, by strictly enforcing the requirements of the Act and Special Rules with a view to increased safety.

Alteration in Summaries this Year.

The summaries this year, in accordance with your instructions, have been made out in a different manner to that which has been customary for a long number of years past, and consequently the comparison will not at first be as intelligible as usual to those accustomed to the old arrangement.

During the year under review, there have been 50 fatal accidents, accompanied by 55 deaths, excluding the accidents and deaths which formerly appeared under a separate table (C.), but which this year in the summaries are taken together for the first time; this, when compared with former years, cannot be deemed very unsatisfactory.

An alteration has been made in the heading of one very important class of accidents, namely, "Explosions of Firedamp," which has been made to read "Explosions of Firedamp or Coal Dust." It has for years past been a disputed point among Mining Engineers whether some of the explosions were due to firedamp or to coal dust, but as proof was not definite, and grounds existed for belief that firedamp was a factor in all these explosions, they have all hitherto been classed under the heading of Explosions of Firedamp. There has been no fatal Explosion of Firedamp in this district during the year, and only three non-fatal which were attended with personal injury, but on the 13th November an explosion (so called) of Dust occurred in the Camerton Colliery, where the Upper Division of the Upper Series of Seams forming the Somersetshire Coalfield is worked. In none of these seams has firedamp ever been met with, either at this colliery or in any other part of the coalfield. This explosion has (in accordance with precedent so far as the dust theorists are concerned) been dealt with and entered in the column of explosions of firedamp, but there being no room for doubt as to the absence of firedamp in this case, it was necessary to include dust as part of the heading, in order that it should be so classified.

This explosion, with the loss of two lives, is due to the use of gun or blasting powder (the most dangerous explosive as regards flame) on one hand, and the absence of precaution by watering on the other.

I have been obliged to include as colliery accidents one or two which have in my opinion very slight grounds for the claim, one especially, in which the injury was only slight, it occurred to the man's wrist by a piece of stone, which he was pulling down from the roof, catching it, but not incapacitating him for some days. He appears to have been a member of the Permanent Relief Society, and to have drawn sick pay from it for 43 weeks; he was able to be about the greater part of the time, if not up to within a short time before his death. He is alleged to have died from the effects of blood poisoning supervening upon the injury caused by this accident, but the matter has been much commented upon, and grave doubts raised as to whether his death was due to the effects of the accident or not. The result, I understand, is that the widow receives 5*s.* a week for life from the fund, and 7*s.* 6*d.* a week at present for three children. Another case occurred on Railway Sidings, where the Great Western Railway Company's engine brings the empty trucks to, and takes the full ones away from. The injuries at the time were not considered sufficiently serious to necessitate the accident being reported, but the man subsequently died, erysipelas having supervened. In this case the man was employed by the Mine Owners, but it being optional, he did not belong to the Permanent Relief Society, and consequently his widow is not provided for, as would have been the case had he belonged to it, and she has no claim of any kind upon the employers, as it seems that he was thoughtlessly leaning against the buffers of loaded trucks, between which he was crushed upon the Railway Company's engine pushing them together in order to allow of the sprags, which were in the wheels, being taken out. My difficulty as to whether it should be included or not, lay in deciding whether this occurred on the Colliery siding or branch line, or on the Great Western Company's line. The ground at this point belongs to the colliery, while the rails, sleepers, engine, &c., belong to the railway company. I, however, under all the circumstances, consider it right to include it.

In the early part of the year the trade depression referred to in my last year's report was intensified for a time, and depression continued more or less throughout the first seven months, resulting in serious labour disputes, which are more or less the features of the year.

In the second week of July a strike was commenced in the Forest of Dean, which lasted until the third week in September, there being about 4,000 persons out of employment for 10 weeks. They resumed work upon a sliding scale agreement, which gave them 15 per cent. advance up to the end of the year, when trade fell off and again brought them down to the old rate of wages and short time.

In the early part of the year, in consequence of the insolvency of a firm of colliery proprietors, three collieries were stopped, in the Bristol district, which threw 600 to 700 persons out of employment, and at the end of July a strike commenced in the Bristol and Somersetshire Coalfields, which lasted until the third week in November, and very seriously reduced the output in this part of the district; about 5,000 persons were idle during these 16 weeks, and a large number of them were unable to obtain work for weeks afterwards owing to the condition of the mines. I understand that even three months later 600 or 700 persons were still unemployed. In consequence of the abandonment of some of the seams in the Newbury Colliery, near Radstock, owing to the cost of re-opening and working costs generally, about 150 to 200 persons have been there thrown permanently out of employment, and, I understand by the newspapers, have been obliged to leave the neighbourhood in order to obtain work.

In the second week of August a strike broke out unexpectedly in South Wales at a few collieries, commencing with the hauliers, and although the colliers generally admitted that the strike was wrong from every point of view, no notice of any intention to stop work having been given, the movement spread over the greater part of the South Wales Coalfield and lasted about four weeks, during which time in Monmouthshire and the parts of Brecon and Glamorganshire belonging to this district 18,000 to 20,000 persons were idle.

This latter case is one of those curious labour movements in which the great majority did not sympathise, yet allowed themselves to be led by a small turbulent minority, which may be said to have taken the bit between its teeth and bolted. The generally recognised leaders of the men, even of those who were in sympathy with that section which belongs to the Miners' Federation of Great Britain, denied any connexion with originating the strike, while those leaders who, on behalf of the majority of the miners of the coalfield, negociated the Sliding Scale Agreement for the regulation of wages, and which could not be altered before the 1st September 1894, deprecated the movement as being illegal, dishonourable, and unwise. So far as I have been able to judge, this is the general opinion of the men themselves since they have had an opportunity of looking at it calmly. Without benefitting any one, they lost a month's wages, and a good opportunity of improving their position.

The Forest of Dean men, upon resuming work, were able to make up for a good deal of their stoppage, as for some months they had full and regular work in consequence of the continuance of the strike in the Midlands. The Sliding Scale upon which they resumed work gave them 15 per cent. advance of wages, which materially helped them to recover their loss while the Midland colliers continued idle. At the end of the year they decided to give notice for the termination of the Sliding Scale in July; they appear to consider that it was only a temporary arrangement to enable them to resume work at the time when it suited them.

In Monmouthshire, upon resumption of work subsequent to the strike, there was a very large output of coal, and, as may be seen by reference to the summaries, the quantity of coal raised during the year in Monmouthshire and the parts of Brecon and Glamorganshire was only 88,332 tons less than in the preceding year, instead of at least 500,000 tons which might have been expected.

The prospects in the coal trade at the end of February of the present year seem far from encouraging. Prices have fallen, and short time has been commenced. Where and what it will lead to cannot be prognosticated, but I anticipate at least some months of bad trade.

Safety Lamps.

The returns made to me show that 15,707 Safety Lamps were in use at the collieries in this district during the year, being an increase of 3,445 as compared with 1892. The respective numbers in use in previous years will be seen on page 7. Of these lamps 10,372 were locked with the lead plug and 5,331 with a screw. I have convinced some of the strongest opponents to the change from the screws to lead plugs that it is desirable, and that insecurity, as also injustice, occurs to the workmen from the continued use of the screw lock.

The increased use of safety lamps has been attended with very satisfactory results. There was no fatal explosion of firedamp (although *one of coal dust* appears under the heading of "Explosion of Firedamp and Coal Dust,") during the year, and only four non-fatal ignitions, attended in three instances with slight personal injury to one person in each. In one case there was no personal injury sustained, while in another I cannot help thinking the management was morally, although not legally, to blame, while the other two resulted from the ordinary use of naked lights in seams or mines where firedamp is occasionally, although not very frequently, met with.

I was much surprised recently to find that Messrs. Hoskins and Llewellyn have not yet fulfilled their promise referred to in my last year's report. They inform me that having in November last put about 50 lamps into use, the men considered that they were not necessary, and refused to work with them. I have yet to learn that the workmen are the responsible persons for the management and direction of the collieries in this district, and if a fatal accident should occur at these collieries, I consider the Owners and Manager would be likely to find themselves in a very tight corner. I hope they will now lose no time in giving effect to their promise.

There are also some other collieries where naked lights are in use, and where the Owners, Agents, and Manager take a serious responsibility upon themselves by allowing them, although there do not appear to have been results sufficient to enable me to advise arbitration with sufficient prospect of success as matters stand at present.

Hartley Surplus Relief Funds.

These several funds for (1) Gloucestershire, Bristol Division; (2) Gloucestershire, Forest of Dean Division; and (3) Monmouthshire, have continued in operation during the year. In my last year's report I set forth the balances in hand of the several funds, and do not consider it necessary to do so this year. Mr. G. C. Hewitt, of Coalpit Heath Collieries, continues secretary for the Bristol Fund, and Mr. G. H. Rawlinson, of Cinderford, and Mr. Thomas Latch, of Newport, for the Forest of Dean and Monmouthshire Funds respectively.

Treatment of Animals.

At the end of the year, in consequence of some allegations by parties connected with the Society for the Prevention of Cruelty to Animals, that the horses are not sufficiently humanely treated in collieries, I issued a circular letter to the owners of collieries in this district drawing attention to the special rules established for their mines, and requesting that full effect might be given to them.

With few exceptions, which will naturally occur from time to time in the hands of such a large number of persons, I believe the animals are well taken care of, better probably than is the case in many instances on the surface.

If want of care or ill-treatment came under my notice and the Owners or officials failed in their duties in regard thereto, I would not hesitate to bring the matter under your notice with a view to proceedings being instituted against them.

I have recently had the result of a prosecution notified to me, in which a Master Haulier was prosecuted on behalf of the owners, and fined 1*l*. and costs, for ill-treating an animal, in addition to losing his situation, which he had held for 14 years.

Statistics.

The total number of persons employed during the year in and about the 224 mines at work in this district (including those employed on branch railways, and washing and coking establishments, away from the mines) was 43,663, an increase of 203 as compared with the previous year. Of this total 37,079 (or an increase of 364) were employed below ground, and 6,584 (or an apparent increase of 687, but really a decrease of 161) were employed on the surface. The total quantity of mineral raised was 9,692,207 tons (a decrease of 507,837 tons, as compared with the previous year). Of this quantity 9,589,151 tons were coal (a decrease of 496,596 tons), 75,890 tons were fireclay (a decrease of 5,228 tons), 18,791 tons were ironstone (a decrease of 6,009 tons), and 8,375 tons were other minerals (a decrease of 4 tons).

The number of fatal accidents which occurred during the year, including those on branch railways and in cokeing and washing of coal, was 53, resulting in 58 deaths. Of these, 43 accidents and 48 deaths occurred underground, while 10 accidents and 10 deaths occurred above ground. Three of these latter were on railways, and in former years were classed under a separate heading (C), and not included here.

The number of persons employed for each fatal accident was 824 (but 856 as compared with former reports), and for each death 752 (but 778 when compared with former reports). The number of tons of mineral raised for each fatal accident was 182,871 (but 193·844 as compared with former reports), and for each death 167,107 (but 176·222 as compared with former reports), which it will be found, by referring to the table on page 8, compares favourably with previous years, and when the output lost by the strike is considered the result is fairly satisfactory, although still leaving much room for improvement by increased discipline and enforcement of the Rules.

TABLE showing for each Year since 1873 the NUMBER of SAFETY-LAMPS in use; the NUMBER of PERSONS EMPLOYED; the QUANTITY of MINERAL RAISED; the NUMBER of FATAL ACCIDENTS and DEATHS from EXPLOSIONS, from FALLS and from ALL CAUSES; with respective ratios of PERSONS EMPLOYED and MINERAL RAISED for each DEATH; and also the NUMBER of NON-FATAL ACCIDENTS, from FALLS and also from ALL CAUSES.

Year.	No. of Safety-lamps in use.	Number of Persons employed.	Quantity of Minerals raised.	Firedamp and Coal Dust Explosions.				Falls of Roof and Sides.				From all Causes.				Non-fatal Falls of Roof and Sides.				Non-fatal Accidents from all Causes.	
				Fatal Accidents.	Deaths.	No. of Persons employed for each Death.	No. of Tons of Minerals raised for each Death.	Fatal Accidents.	Deaths.	No. of Persons employed for each Death.	No. of Tons of Minerals raised for each Death.	Fatal Accidents.	Deaths.	No. of Persons employed for each Death.	No. of Tons of Minerals raised for each Death.	Accidents. Roof.	Accidents. Sides.	Accidents. Total.	No. of Persons injured.	Accidents.	No. of Persons injured.
1872 ACT.																					
1873	—	35,352	7,108,930	2	7	5,050	1,015,561	36	37	955	192,113	62	69	512	103,028	Not obtainable		106	108	215	229
1874	—	34,852	7,178,728	1	1	34,852	7,178,728	35	35	995	205,106	64	64	544	112,167	Ditto		125	128	276	297
1875	1,755	34,136	6,437,322	5	32	1,066	201,166	30	32	1,066	201,116	54	83	411	77,558	Ditto		134	143	292	310
1876	1,804	33,224	7,388,076	4	29	1,146	254,761	29	30	1,107	244,602	48	74	449	99,758	Ditto		200	208	348	367
1877	1,814	31,906	7,249,998	2	2	16,612	3,124,999	30	31	1,029	233,870	53	55	580	131,820	Ditto		205	212	346	367
1878	2,194	30,874	7,331,148	1	268*	115	27,355	44	45	686	162,914	65	333	93	22,015	135	73	208	209	352	366
1879	2,037	30,060	7,557,870	2	9	3,340	839,763	46	48	426	157,455	66	75	400	100,771	139	83	222	225	376	386
1880	2,949	29,811	7,997,879	2	126†	237	63,475	29	31	941	257,996	49	175	170	45,702	103	65	168	172	290	303
1881	2,971	31,044	8,575,899	None.	None.	31,044	8,575,899	39	41	757	209,168	63	68	457	126,116	105	52	157	162	290	301
1882	3,638	31,672	8,774,339	3	11	2,879	797,667	36	36	879	243,731	63	73	434	120,196	105	54	159	163	324	352
1883	3,541	33,759	9,463,742	4	9	3,751	1,051,527	31	31	1,080	305,282	63	83	496	139,172	127	63	190	193	328	355
1884	3,983	34,945	9,703,086	3	16	2,121	606,434	31	31	1,127	313,002	58	71	492	136,663	110	46	156	170	299	322
1885	5,047	35,659	9,478,018	2	3	11,886	3,159,339	37	37	963	256,162	69	70	509	135,400	108	54	162	165	306	337
1886	5,283	34,869	9,363,541	5	22	1,585	425,614	27	27	1,291	346,797	59	80	435	117,044	109	61	170	177	315	344
1887	5,937	35,991	9,765,517	1	1	35,991	9,765,517	33	34	1,058	287,221	53	54	666	180,843	77	53	130	130	259	268
For 15 years	—	498,154	123,374,093	37	536	929	230,176	513	526	947	234,551	889	1,427	349	86,457	—	—	—	—	—	—
1887 ACT.																					
1888	6,585	36,151	9,970,573	None.	None.	—	—	27	29	1,246	343,831	50	55	657	181,283	95	32	127	127	267	277
1889	7,455	38,154	9 972,983	2	5	7,631	1,994,596	33	35	1,090	284,942	59	65	587	153,431	68	31	99	108	215	236
1890	9,400	40,938	10,223,922	3	182‡	225	56,175	31	31	1,320	329,804	56	237	172	43,138	56	36	92	92	223	238
1891	11,868	43,568	10,350,987	4	14	3,110	739,350	26	26	1,676	398,115	53	63	691	164,301	57	23	80	80	187	196
1892	12,262	42,612	10,200,044	1	1	42,612	10,200,044	25	26	1,639	392,309	51	56	761	182,143	65	29	94	97	202	214
1893	§15,707	‖43,663	9,692,207	1	2	21,832	4,846,104	27	29	1,505	334,214	53¶	58¶	752	167,107	65	31	196	98	175	179

* Abercarn explosion (268). † Risca explosion (120). ‡ Llanerch explosion (176).

§ Of these 15,707 Safety Lamps 10,372 are locked by means of a lead plug.

‖ In 1893 the persons employed (848) on branch railways and in the washing and working of coal are for the first time included, as are also the fatal accidents and deaths (three each) connected therewith. This upsets the figures for comparison with past years.

¶ For comparison with previous years these should read 50 and 55 respectively.

The annexed tabulated statement shows the number of persons employed, the number of tons of minerals raised, and the ratio per fatal accident, and per life lost for several years past:—

—	*1877.	1885.	1886.	1887.	1888.	1889.	1890.	1891.	1892.	‡1893.
Total number of persons employed.	31,906	35,659	34,869	35,991	36,151	38,154	40,938	43,568	42,612	43,663 (*a*)
Tons of mineral raised	7,249,998	9,478,018	9,363,541	9,765,517	9,970,573	9,972,983	10,223,922	10,350,987	10,200,044	9,692,207
Number of collieries	394	294	297	306	286	289	267	265	238	224
Number of fatal accidents.	51	69	59	53	50	59	56	53	51	53 (*b*)
Number of lives lost -	53	70	80	54	55	65	237	63	56	58 (*c*)
Number of persons employed per fatal accident.	625	516	591	679	723	647	731	842	835	824 (*d*)
Number of persons employed per life lost.	602	509	435	666	657	587	173	691	761	752 (*e*)
Number of tons of mineral raised per fatal accident.	142,157	137,362	158,704	184,255	199,411	169,033	182,570	195,301	200,000	182,871 (*f*)
Number of tons of mineral raised per life lost.	136,792	135,400	117,044	180,843	181,283	153,431	43,139	164,301	182,143	167,107 (*g*)
Number of tons of mineral raised per person employed.	227	266	268	271	276	261	250	237	239	222 †

* This was the most favourable year prior to 1887. † Due to a strike which occurred this year. *See* page 4.

‡ In 1893 the persons employed and accidents occurring in connexion with private branch railways, Washing and Coking of Coal are included with those in and about the mines for the first time, and consequently the ratios naturally show worse results as the accidents are now included which was not previously the case. For comparison with former years these figures should read:—(*a*) 42,818, (*b*) 50, (*c*) 55, (*d*) 856, (*e*) 778, (*f*) 193,844, (*g*) 176,222.

Accidents.

The total number of accidents reported was 228, of which 53 were fatal including 3 on branch railways which heretofore were kept separate under (C.) heading. The fatal accidents resulted in the death of 58 persons and injuries to 5 others; the non-fatal accidents caused more or less serious injuries to 179 persons.

The fatalities are classified for each month as under:—

1893. Month.	Number of Fatal Accidents.	Lives lost Underground.						Lives lost on Surface.			Total deaths.
		Explosions of Firedamp and Coal Dust.	Falls of Roof.	Falls of Sides.	In Shafts.	Suffocation.	Miscellaneous.	Machinery.	Miscellaneous.	Boilers bursting.	
January - -	3	—	5	—	—	—	—	—	—	—	5
February - -	4	—	1	—	—	1	1	—	1	—	4
March - -	3	—	2	—	—	—	1	—	—	—	3
April - -	4	—	—	1	1	—	2	—	—	—	4
May - -	3	—	—	—	3	—	2	—	—	—	5
June - -	5	—	2	—	—	—	1	—	2	—	5
July - -	1	—	1	—	—	—	—	—	—	—	1
August - -	2	—	1	1	—	—	—	—	—	—	2
September - -	9	—	6	1	—	—	1	—	1	—	9
October - -	6	—	—	1	2	—	1	—	2	—	6
November - -	6	2	1	2	—	—	—	—	2	—	7
December - -	7	—	4	—	1	—	—	—	2	—	7
Total - -	53	2	23	6	7	1	9	—	10	—	58

From the foregoing figures it appears that—

2 lives were lost by explosion of firedamp or coal dust.
23 „ „ falls of roof.
6 „ „ falls of sides, including coal at the face.
7 „ „ shaft accidents.
1 „ „ suffocation.
9 „ „ miscellaneous accidents underground.
10 „ „ surface accidents.

The Owners at whose mines the fatal accidents occurred during the year will be seen from the following table:—

Names of Owners at whose Mines the Accidents occurred.	No. of Persons employed in 1893.	No. of Fatal Accidents.	No. of Lives lost.	Classification of the Accidents, &c.				
				Explosions of Firedamp and Coal Dust.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	On Surface.
GLAMORGANSHIRE.								
The Cardiff Steam Coal Collieries Co., Limited.	—	1	1	—	—	1	—	—
The Rhymney Iron Co., Limited. {Glam. 1, Mon. 3}	—	4	4	—	{1, 2}	—	1	—
The Rudry Merthyr Colliery Co., Limited.	—	1	1	—	—	—	1	—
GLOUCESTERSHIRE. (Forest of Dean.)								
Crawshay, H., and Co., Limited	—	1	1	—	—	—	1	—
Foxesbridge Colliery Co., Limited.	—	1	3	—	—	1 (3)	—	—
The Trafalgar Colliery Co., Limited.	—	1	1	—	—	—	1	—
Bristol Division.								
The Coalpit Heath Coal Co. -	—	1	1	—	1	—	—	—
The Kingswood and Parkfield Collieries Co., Limited.	—	3	4	—	3 (4)	—	—	—
MONMOUTHSHIRE.								
The Blaenavon Co., Limited -	—	1	1	—	—	—	—	1
Bryndu Coal and Coke Co., Limited.	—	2	2	—	1	—	—	1
The Coalbrook Vale Coal Co.	—	1	1	—	—	—	1	—
The Ebbw Vale Steel, Iron, and Coal Co., Limited.	—	3	3	—	3	—	—	—
John Lancaster and Co., Limited.	—	6	6	—	2	1	—	3
Lancaster Steam Coal Collieries, Limited.	—	3	3	—	2	—	—	1
The Newport Abercarn Black Vein Steam Coal Co., Limited.	—	5	5	—	2	—	3	—
Partridge, Jones, and Co., Limited.	—	1	1	—	1	—	—	—
The Patent Nut and Bolt Co., Limited.	—	2	3	—	1 (2)	—	—	1
The Powell Duffryn Steam Coal Co., Limited.	—	5	5	—	3	1	1	—
Powell's Tillery Steam Coal Co., Limited.	—	1	1	—	1	—	—	—
The Tir-Pentwys Black Vein Steam Coal Co., Limited.	—	1	1	—	—	1	—	—
The Tredegar Iron and Coal Co., Limited.	—	3	3	—	2	—	—	1
The Tranch Colliery Co.	—	1	1	—	—	—	—	1
Vipond, John, & Co., Limited	—	1	1	—	1	—	—	—
SOMERSETSHIRE.								
Jarret, Miss J. -	—	2	3	1 (2)	—	—	—	1
The New Rock Coal Co. -	—	1	1	—	—	—	1	—
The Writhlington Colliery Co.	—	1	1	—	1	—	—	—
Totals - -	—	53	58	1 (2)	27 (29)	5 (7)	10	10

The non-fatal accidents are classified as follows :—

4	from explosions of firedamp	injuring	4 persons.
65	from falls of roof	,,	67 ,,
31	,, side	,,	31 ,,
6	from explosions of powder and other explosives	,,	8 ,,
4	on incline and engine planes	,,	4 ,,
26	from trams and tubs	,,	26 ,,
1	by machinery underground	,,	1 ,,
4	in shafts from different causes	,,	4 ,,
18	from miscellaneous causes underground	,,	18 ,,
16	,, ,, on the surface	,,	16 ,,
175			179

In consequence of allegations made some years back that the majority of accidents occurred in the first hour of the shifts, owing to the workings not being examined before the men commence work, and in the hours after the 8th, when the men were physically unable to give due attention to the safety of their working places in consequence of exhaustion, the inspectors were instructed to include in their annual reports the hours of the shift in which the accidents occurred. Tables are given in the summaries of statistics for the several districts in regard to the fatal accidents throughout the kingdom. The following table shows the hours of work in which the fatal and non-fatal accidents occurred during the year in this district, viz. :—

—	Underground.												Above Ground.											
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
Fatal accidents	6	3	4	5	3	5	6	1	3	7	—	—	3	1	1	—	1	—	1	—	—	2	1	—
Non-fatal do.	17	21	17	19	23	18	13	13	8	10	1	—	4	2	2	—	1	—	1	2	1	1	1	—
Total fatal and non-fatal	23	24	21	24	26	23	19	14	11	17	1	—	7	3	3	—	2	—	2	2	1	3	2	—
	7	3	3	—	2	—	2	2	1	3	2	—												
Total fatal and non-fatal above and below ground.	30	27	24	24	28	23	21	16	12	20	3	—												

The following table shows the distribution of fatal accidents and deaths among the respective firms under which they occurred during the past eight years, also the total number under each firm.

Names of the Owners of the Mines at which the Accidents occurred.	Fatal Accidents. The Deaths where exceeding the Number of Accidents are shown in ( ).								No. of Fatal Accidents and Deaths.
	1886.	1887.	1888.	1889.	1890.	1891.	1892.	1893.	
GLAMORGAN.									
Caerphilly Coal Co. (abandoned 1892).	—	—	—	2	—	2	—	—	4
Cardiff Steam Coal Collieries Co., Limited.	—	—	1	1	—	1	—	1	4
Rhos Llantwit Coal Co., Limited	1	—	1	—	—	(2) 1	1	—	(5) 4
Rudry Merthyr Coal Co., Limited	—	1	1	—	—	1	—	1	4
Rhymney Iron Co., Limited { Glam. Mon. }	3	4	(3) 2	3	4	3	3	4	(27) 26
GLOUCESTER (BRISTOL).									
Coal Pit Heath Co.	1	—	—	—	1	1	—	1	4
Kingswood and Parkfield Collieries Co., Limited.	1	—	1	2	—	3	1	(4) 3	(12) 11
Leonard, Boult, and Co., Limited	(8) 1	—	—	1	—	—	—	—	(9) 2
Rangeworthy Colliery Co. (abandoned 1888).	1	—	—	—	—	—	—	—	1

NOTE.—The figures in ( ) are the deaths resulting from the respective accidents.

Names of the Owners of the Mines at which the Accidents occurred.	Fatal Accidents. The Deaths where exceeding the Number of Accidents are shown in ( ). 1886.	1887.	1888.	1889.	1890.	1891.	1892.	1893.	No. of Fatal Accidents and Deaths.
GLOUCESTER (FOREST OF DEAN).									
Crawshay, H., and Co., Limited -	2	—	1	—	2	1	—	1	7
Dean Forest Navigation Coal Co. (formerly P. Holmes and Son).	—	—	(3) 1	—	2	—	—	—	(5) 3
Foxes Bridge Colliery Co., Limited	—	—	—	1	—	—	2	(3) 1	(6) 4
Gt. Western Colliery Co., Limited	—	—	—	—	1	1	—	—	2
Lydney and Crumpmeadow Co., Limited.	—	1	—	—	—	1	—	—	2
Morse, T. - - -	—	—	—	1	—	—	—	—	1
New Bowson Coal Co. - -	—	1	—	—	1	—	—	—	2
Old Norchard Colliery Co. -	—	—	—	1	—	—	—	—	1
Parkend Deep Navigation Collieries, Limited.	—	—	1	—	—	—	1	—	2
Park Iron Mines and Collieries Co., Limited.	—	—	—	—	—	1	—	—	1
Princess Royal Colliery Co. -	—	—	—	—	1	—	—	—	1
Rosser, J. - - -	—	—	—	—	1	—	—	—	1
Richard Thomas & Co. - -	—	—	—	—	—	—	1	—	1
Trafalgar Colliery Co., Limited -	—	—	1	—	—	—	—	1	2
Wanklyn, E., and Co. - -	—	—	—	1	—	—	—	—	1
Wilce, W. - - -	—	—	—	—	1	—	—	—	1
MONMOUTH.									
Abersychan Elled S. and H. Coal Co.	2	1	—	—	—	2	1	—	6
Blaenavon Co., Limited - -	2	5	1	4	3	2	(2) 1	1	(20) 19
Bryndu Coal & Coke Co., Limited	—	—	—	—	—	—	(4) 3	2	(6) 5
Cartwright, Executors of - -	1	—	—	—	1	—	—	—	2
Clapp & Co. - - -	—	—	—	—	1	—	—	—	1
Coalbrook Vale Colliery Co. -	2	—	4	1	2	1	1	2	13
Diamond Llantwit - -	—	—	—	1	—	—	—	—	1
Ebbw Vale S., I., and C. Co., Limited.	6	3	(5) 4	7	(10) 6	3	3	2	(39) 34
Gelli and Tynybeddw Colliery Co., Limited	—	1	—	—	7	—	1	—	3
James and Emmanuel - -	1	—	—	—	—	—	—	—	1
Jones, Lewis, & Co. - -	—	—	1	—	—	—	—	—	1
Lancaster, J., & Co. - -	2	3	1	5	2	2	2	6	23
Lancaster Steam Coal Collieries, Limited (formerly South Wales Colliery Co.)	2	2	3	(5) 4	1	2	3	3	(21) 20
Latch, J., & Co. - - -	1	—	—	—	—	—	—	—	1
Monmouthshire and Cwm Colliery Co.	2	—	1	—	—	—	—	—	3
Newport Abercarn Co., Limited -	2	3	4	2	—	—	—	5	16
Partridge, Jones, & Co., Limited -	—	2	1	2	(180) 5	2	1	1	(189) 14
Patent Nut and Bolt Co., Limited	1	3	1	2	2	—	—	(3) 2	(12) 11
Phillips, P. S. - - -	1	—	—	—	—	—	—	—	1
Pond, C. - - - -	—	—	—	—	—	1	—	—	1
Powell, Duffryn, S. Coal Co., Limited.	2	1	—	2	4	1	(7) 5	5	(22) 20
Powell's Tillery S. C. Co., Limited	—	1	—	—	(3) 1	1	1	1	(7) 5
Smith, J. L., & Co. - -	—	—	—	—	1	1	—	—	2
Smith, J. - - -	—	—	—	1	—	—	—	—	1
Stone, J. & W. - - -	—	1	—	—	—	—	1	—	2
Tir Pentwys B. V. S. C. and Coke Co.	—	—	—	—	—	1	—	1	2
Tranch Colliery Co. - -	—	—	—	—	—	1	—	1	2
Tredegar Iron and Coal Co., Limited.	3	10	(6) 5	6	2	7	5	3	(42) 41
United National Collieries, Limited, { Risca -	(4) 3	—	3	—	2	—	3	—	(12) 11
United National Collieries, Limited, { Abercarn -	2	3	—	1	1	3	2	—	12
Vipond, J., & Co. - -	2	1	2	2	—	—	2	1	10
Williams, J. - - -	—	—	—	—	—	1	—	—	1

NOTE.—The figures in ( ) are the deaths resulting from the respective accidents.

Names of the Owners of the Mines where the Accidents occurred.	Fatal Accidents. The Deaths where exceeding the Number of Accidents are shown in ( ).								No. of Fatal Accidents and Deaths.
	1886.	1887	1888.	1889.	1890.	1891.	1892.	1893.	
SOMERSET.									
Ashton Vale Iron Co., Limited	2	3	3	(4) 2	2	3	(2) 1	—	(19) 16
Bedminster Coal Co.	(11) 2	—	1	(5) 2	—	1	2	—	(20) 8
Bristol Collieries Co., Limited	—	1	—	—	1	(10) 1	—	—	(12) 3
Daubeney and Scobel	(4) 1	1	—	—	—	—	—	—	(5) 2
Edford Colliery Co.	(2) 1	—	—	—	—	—	—	—	(2) 1
Evans, W., & Co.	1	—	—	—	—	—	—	—	1
Farrington Colliery Co.	2	1	1	—	—	—	—	—	4
Hollwey, C., Trustees of	—	—	1	—	1	—	—	—	2
Jarret, Miss A. M.	—	—	—	—	—	—	1	(3) 2	(4) 3
Kilmersdon Colliery Co.	—	—	1	—	—	—	—	—	1
New Rock Coal Co.	—	—	—	—	—	—	—	1	1
Warwick, Earl of	—	—	1	1	—	—	—	—	2
Welton Hill Colliery Co.	1	—	—	—	—	—	1	—	2
Waldegrave, Trustees of the late	2	—	1	—	—	1	1	—	5
Westbury Iron Co., Limited	—	—	—	—	2	—	1	—	3
Writhlington, Huish, and Foxcote	—	—	—	1	1	—	—	1	3
Totals	(80)59	53	(55)50	(65)59	(237)56	(63)53	(56)51	(58) 53	(666) 434

NOTE.—The figures in ( ) are the deaths resulting from the respective accidents.

Explosions of Firedamp and Coal Dust.

There, properly speaking, was no fatal accident under the heading "Explosions of Firedamp," and I had prepared this part of my report, at first, based upon that fact, having entered the explosion which occurred at Camerton Colliery under the category of "Explosives." When, however, with my colleagues tabulating the statistics from other districts for the kingdom, it was considered right that it should be classed under this heading, to which has been added, as above, "and Coal Dust," in order to meet this and other cases which have been so entered, although deemed by some to have resulted from coal dust and not from firedamp.

There is, therefore, one fatal accident to include under this heading. It occurred at Camerton Colliery, about 3 or 4 miles from Radstock, in the county of Somerset. I have, in accordance with your instructions, made a "particular" report on the subject, dated 4th January, which has been published separately. I may, however, here summarize the matter thus:—

At Camerton Colliery five of the eight seams constituting the Upper Division of the Upper or Radstock Series of the Somersetshire Coalfield are worked. The colliery has been working for about a century. Firedamp has not only been absolutely unknown in the colliery during that long period, but it is totally unknown to have ever been met with in any of these seams throughout the coalfield. Naked lights were used. Loose powder was allowed, exemption to the provisions of the Act with regard to cartridges having been granted. On the night of the 13th November, two men were engaged at a point 2,100 yards from the shaft in an incline plane ripping roof, in order to make height for the trams and tubs to pass freely. They had drilled a hole $1\frac{3}{4}$ to $1\frac{7}{8}$ inches in diameter, with a patent hand boring drill, about 10 inches deep, and the charge cannot have been more than $\frac{1}{2}$ lb. to $\frac{3}{4}$ lb. of ordinary blasting powder. The shot was intended to rip down the roof in advance of the end of the hole, and it apparently was, although rather a short hole, properly charged, stemmed, and fired. Since the explosion occurred a joint in the clift roof is seen to have existed, about 3 inches beyond the end of the hole, which cut off the intended work and caused the charge to be excessive. The height of the place was about 4 feet, and the floor, &c., was thickly covered with dust; which became disturbed and ignited by the shot being overcharged, with the result that heat and force were generated in the form of an explosion, the effect of which was to wreck the intake air road (a horse road) for 1,200 yards towards the shaft The road was dry and dusty, with the exception of about 30 yards at the bottom of the incline, to a point 900 yards from the scene of the shot, and a further 300 yards was alternately dusty and damp, and the current of air was travelling at about 300 feet per minute.

The two men were found dead on the incline, 40 or 50 yards "outbye" from the shot, having been burned more or less, but no doubt their death was the result of asphyxiation.

The explorers got to the place (2,100 yards from the shaft) in about eight hours, using naked lights both in the return and intake airways before the stoppings were replaced, &c.—a very severe test for gas. Further experiments were made by shutting off the whole of that part of the mine by stoppings for two or three weeks, but no trace of firedamp could be found when re-opened in my presence.

This is the practical experiment which has been wanted to demonstrate the dust theory, as in no previous case could it be definitely stated that firedamp had not occurred more or less in some part of the seam or mine.

The non-fatal explosions were:—

Date.	Mine.	Owners.	No. of Persons injured.	Circumstances.
1893. Feb. 8	Llanbradach (Sinking Pit)	The Cardiff Steam Coal Collieries Co., Limited. (Not attended with personal injury.)	—	While 12 men were engaged walling the shaft on a scaffolding about 30 yards from the bottom some gas became ignited; how it occurred is unknown, as no naked light, it was alleged, was allowed in the shaft, and the men all state that they saw none there at the time. Holes have since been left in the walling in order to allow of the gas escaping as given off. Gas had been met with previously. The 12 men jumped into the bowk and came up the shaft at once, without any of them being injured. The gas continued burning until extinguished by water pumped down the shaft, and the cutting off of the ventilation.
May 8	Henllis	The Patent Nut & Bolt Co., Limited.	1	Firedamp never having been found in this colliery, the examiner in the morning, in accordance with the usual practice, went round the places with a naked light. This time he did it once too often, and ignited some gas in one of the headings, which burned him more or less seriously. It was, perhaps, legal to use a naked light, but I was surprised to learn that the manager allowed such a practice, especially as the Rock or Black Vein is the seam worked. This mine has since been worked with safety lamps.
June 26	Tredegar (No. 7 Pit.)	The Tredegar Iron & Coal Co., Limited.	1	A collier going in along a roadway came to a large fall, and was trying to get over it, having a naked light with him. On getting up into the cavity he ignited a little gas, and was slightly burned. It was not thought possible that firedamp could occur in the place, as there were only a few yards of cover up to the surface.
Nov. 15	Varteg Hill	J. Vipond & Co., Limited.	1	A collier put his naked light into a cavity where a fall had occurred over some timber, and ignited a small quantity of firedamp. The management should take this warning and put in safety lamps with a view to the prevention of any such accident in the future.

Falls of Roofs and Sides.

Of the 27 fatal accidents and 29 deaths which appear under this classification, 21 accidents and 23 deaths resulted from falls of roof, the remaining six accidents and six deaths being due to falls from the side, including the coal face. I am sorry to see that the figures are rather larger than in the previous year instead of smaller, as I hoped would have been the case. It reflects more or less unfavourably upon the management of the collieries, if

even it may be said that there was no case in which direct negligence on the part of the officials was proved. In connexion with this matter, it will be known to more than one or two of the managers, that laxity in the matter of timbering and spragging has existed in consequence of the rules not being enforced. In one case the manager gave the overman and seven of the colliers of one district in a mine the option of signing an apology, to be printed and posted up at the works or to go before the justices, the former for not reporting cases of not properly spragging, and the latter for not having their places properly spragged. I again repeat that, although it is probably pleasanter for an official to tell Jack, Tom, or Harry to set a prop or sprag where he finds a place insufficiently timbered (propped or spragged) than to report him to the Manager, in order that he should be dealt with in some efficient manner, it must be done, and after all it is a mistaken kindness, as the effect is, that if he wants to get some other work done, a tram filled, &c., he chances the danger, and continues to work without setting the necessary timber, knowing that if the official comes into the place, he will only tell him to set it, whereas if he knows that when the official comes into the place and finds the timber not set, he will report him, he (the collier) will say to himself, "I'll set this timber at once, it won't take me very long," and then the official may come as soon as he likes.

There is little doubt that complete immunity from accidents of falls of roof and sides is an impossibility, but much may be done in this matter, as in other things, by strict discipline and increase use of supports.

Since writing my last year's report, the whole matter has presented itself to me in a somewhat new light, so far as the present law is concerned, and I am inclined to think that the manager of each colliery would be doing himself justice to fix upon maximum distances at which timbers shall be set, and take means of seeing that his orders are complied with, if necessary, by examination of the places by officials two, three, or four times during the shift. By fixing upon a maximum distance for standing props, or supports of whatever kind, a fixed starting point is arrived at, which would be a guide to the officials and workmen with regard to the area of roof, which might under the best of circumstances be allowed to remain unsupported. Looking at the present practice and the condition of the law, I find that the setting of timber is practically left to the collier, who is supposed to use his judgment as regards its safety, if he gives it any special thought at all. No doubt the majority do so, but unfortunately it is human to omit doing things we should do, and to procrastinate over them, which is only too frequently the cause of accident under this heading. Colliers are naturally liable to consider roofs good, where they will, under ordinary circumstances, stand over a moderately large area, even though they know that invisible slips and slants resulting in falls which frequently occur from them, and which possibly, if not probably, injure someone. "It was as sound as a bell" is a frequent answer at inquests.

If we look at the legal aspect of the case, I think managers may, perhaps, more fully realise the situation. General Rule 21 is imperative, and specifies that "the working places *shall* be made safe," and the 57th section of the Act renders the Owner, Agent, and Manager responsible, unless they show that they have taken all reasonable means in their power to make known and to *enforce* the requirements of the General and Special Rules.

These rules are governed by the words "so far as reasonably practicable," but these have been held to refer only to the physical or engineering difficulties, and in no wise to the one of convenience or profitable working of the mine.

Seeing that from the physical or engineering point of view there is no necessity for large areas of roof, or lengths of working faces to be left unsupported, it would appear that the Owners, Agents, and Managers are responsible for not enforcing their rules, in cases of accidents or injuries, where timbers are not set at moderate distances apart.

The Special Rules generally put the responsibility, in the first place, upon the collier to make his place safe, but by doing so, like specifying the maximum distances between timbers, it does not relieve the Owner, Agent, and Manager from adopting sufficient supervision to see that he does do so, and unless they can show that they have done so, and that they adopt means to enforce the requirements of the rules, they do not become exonerated.

The 4th General Rule requires that an official shall visit the working places at least once during each shift, but in many instances at Inquests the answer of the official is that, "I was on my way to the place, but I had not reached it," or "I was in the place four or five hours before, at which time it was safe." It would appear to be no exoneration from responsibility on the part of the Owner, Agent, and Manager, if through the man's neglect to timber he was killed, unless they could show that not only was the minimum amount of supervision

exercised as laid down by law, but so much more as would reasonably enable the contravention to be detected and punished.

I hope as the death-rate under this heading has lessened so slowly under the principle hitherto practised of leaving the timbering almost entirely to the judgment of colliers, that Owners, Agents, and Managers will accept a warning that something further will have to be done in order to prevent such a heavy cost in life and limb from this source, and that they will increase supervision and strictly enforce the rules as to timbering.

Coroners, I think, would do well to look into the legal aspect of the question, and, on doing so, they may possibly come to the conclusion that they have applied the "so far as reasonably practicable" differently to what it means in law, as decided in the case of Wales *v.* Thomas, 16 Q.B.D. 340.

In Shafts.

There were five fatal shaft accidents, resulting in seven deaths.

At New Tredegar Colliery (Mon.) on the 28th April, some men reached the bottom of the shaft in order to ascend, and rushed into the cage after it had been signalled away. On the cage being drawn up some yards, deceased fell out, his clothes having probably caught in something and dragged him out.

At Foxesbridge Colliery (Forest of Dean) on the 28th May, four men were engaged with pump work, and were ascending on the cage-top, when, in consequence of its oscillating, it caught under a protruding spindle, resulting in the four bridle chains snapping, and three of the four men being precipitated to the bottom; the fourth clutched one of the wire-rope guides, and lowered himself a few yards to a point where he was able to get on to some of the "buntons" or "horse-trees."

It was shown at the inquest that the cage had been pushed out of the line of the guides, in order to enable one of the party who was on one of the "horse-trees" to step on to it, and that they then signalled to be wound up without steadying it properly. There were two wire-rope guides to the cage, and probably they would have been sufficient under ordinary circumstances for years to come. I, however, requested that with this experience before them, they should apply two additional guides, which has been done.

At (Henwain Pit) Blaina Colliery (Mon.) on the 29th October, the hitcher at the bottom of the shaft was fatally injured, while fulfilling his ordinary duties, by a piece of coal which fell from the surface, while the loaded cage was being banked. With the system of piling coal up on trams, which is customary in Monmouthshire and South Wales, the wonder is that more fatalities do not occur from this source of danger than is the case.

At Tir Pentwys Colliery (Mon.) on the 26th October, in sinking operations one of two sinkers who had got out of the "bowk" or bucket, in order to pull out some of the fuzes (of five shots) which had been lit up, seeing that the bowk was being wound up, clung to the edge of it, and was drawn up about 40 yards. He was, however, unable to maintain his hold until they could land him at a mouthing close by; the men in the bowk were also unable to hold him, and consequently he fell to the bottom and was killed. The other man, who had also got out of the "bowk," and who was left in the bottom, marvellously escaped serious injury, notwithstanding that three or four of the shots which were in hard ground went off.

It occurred through the rapper line breaking as the signal was given to wind them up from the shots. A momentary delay in winding up seems to have occurred, in order to allow of the person signalling reaching the bowk, or with the banksman having to repeat the signal to the engineman, and under the circumstances, the men were afraid that it was due to the signal not having reached the surface before the breakage occurred, hence they were about to get out (which two of them had done) in order to draw the fuzes, when the engineman wound up the bowk.

I think it would be better to have had the signalling arrangements carried into the engine-house direct, instead of the banksman having to repeat the signals, which causes delay, as well as an extra liability to mistake. Unless some special grounds exist for a different arrangement, I favour the signals being received in the engine-house and at the bank top simultaneously, as practised in large and well organised collieries.

At Llanbradach Colliery (Glam.) on the 8th December, the banksman, while engaged getting the box used by fitters and shaftmen for working in the shaft ready for them, was precipitated down the shaft 500 yards, owing to the breakage of some of the side boards of the box, due to the manner in which it was slung. The arrangements for this work were crude and unsatisfactory.

The non-fatal shaft accidents were :—

Date.	Mine.	Situation.	Owners.	No. of Persons injured.	Causes.
1894. March 7 -	Huish - -	Radstock -	The Writhlington, Huish, and Foxcote Colliery Co.	1	The hitcher in consequence of stepping out before it was at rest was slighty injured by the cage at a mouthing to which he was going in order to send trams from it.
March 27 -	Blaensychan -	Cwmnantddu	Partridge, Jones & Co., Limited.	1	Struck by a pick which was being sent up the shaft on a tram, falling down and catching him.
April 25 -	Sirhowy (No. 7 Pit.)	Sirhowy -	The Ebbw Vale Steel, Iron, and Coal Co., Limited.	1	Descending a shallow shaft by ladder, he slipped and fell across some of the ladder staves.
May 31 -	South Liberty	Bristol -	The Ashton Vale Iron Co., Limited.	1	Struck by a piece of one of the wooden guides about 2½ feet in length, which was broken off by the descending cage while he was ascending in the other. The guides were not in a satisfactory condition, and it was fortunate that nothing worse than this slight injury occurred.

By Explosives.

The only fatal accident classed under this heading occurred on the 17th February, at New Rock Colliery, in Somersetshire, when before commencing work some men on reaching the place where they usually took off their clothes in the mine, were filling straws for blasting purposes. While so engaged a spark flew from their candle and ignited the powder, which burned two of them so severely that one succumbed to the injuries in a few days, and the other was laid up for some time.

Naked lights and loose powder are used in the mine throughout, the provisions of the 12th General Rule as regards cartridges being exempted.

The following non-fatal accidents occurred in connexion with the use of explosives :—

Date.	Mine.	Owners.	No. of Persons injured.	Circumstances.
1893. Jan. 10 -	Henllis -	The Patent Nut and Bolt Co., Limited.	1	While unramming a missed shot, it exploded, and burned the miner's hands and face. Such accidents give an impression that the discipline of the overmen and firemen is not strict enough. The manager should see to this, and require all contraventions of rules to be reported to him.
Feb. 10 -	Dean Lane -	The Bedminster Coal Co.	1	A portion of a hole charged with dynamite in hard ground having been blown off, a miner was engaged in deepening the remaining portion for another shot, when an explosion suddenly occurred, and injured him. Either the nitro-glycering had exuded and been absorbed into the stone, or some had remained unconsumed, and exploded by the concussion from the drills.
March 2 -	Blaenavon (Big Pit)	The Blaenavon Co., Limited.	1	A miner was charging a hole, and after putting stemming on the powder was, contrary to the Special Rules, forcing a copper pricker through it, when the explosion occurred and injured him.

Accidents by Explosives—continued.

Date.	Mine.	Owners.	No. of Persons injured.	Circumstances.
1893. March 22 -	Parkfield -	Kingswood and Parkfield Collieries Co., Limited.	2	A shot in hard ground having hung fire, they thought it had missed, and after awaiting about 15 or 20 minutes they returned to it, instead of waiting at least one hour as required by the Special Rules. They were close to the shot when it went off, and one of the men was very severely injured; it is a wonder that they were not both killed.
April 8 -	Edford - -	Holcombe, near Bath	1	A miner, having tried to light two shots, withdrew; one seems to have hung fire a little, or to have had a slower fuse; he thought he had not succeeded in lighting both, and was on his way to light the second when it went off, and threw some stone about eight yards, where it struck him and broke his collar bone.
May 18 -	Golynos -	The Abersychan Elled Steam and House Coal Co.	2	A shot charged with powder in a branch having missed fire, some dynamite was placed on the top of the hole and exploded in order to blow it off. While subsequently examining the result with a naked light, the men appear to have ignited the fuse of the original shot which went off and injured them.

Suffocation by Gases.

On the 1st February, at Celynen Colliery, a labourer seeking a shovel which he had lost a few days previously, climbed up into a cavity in the roof which extended some yards from the side of the roadway, and contained firedamp. He was overcome by the gas, and was dead when found.

The cavity is alleged to have been examined a few hours before and found clear, and also that it had been clear since a sheet was hung across the roadway some weeks before when a small quantity of firedamp was found there. The seam (Black Vein) is of a very fiery nature in this colliery, and requires very strict and close supervision.

Trams and Tubs.

Eight accidents, causing eight deaths, occurred in connexion with trams and tubs.

A haulier at White Rose Level (Mon.), on the 9th March, apparently in attempting to put sprags into the wheels of the loaded trams, which he was conveying along the horse road, stumbled, and struck his head against something, probably the sides of the road, which caused his death. Owing to his not bringing the trams as usual, another haulier went to seek him, and ascertain the cause of delay; he was found lying dead on the road some distance behind where the horse and trams were standing, some of the trams being off the rails. His injuries indicated in no way that he had been crushed by the trams, and there was at this point ample room, 2½ to 3 feet at the side of the trams, to enable him to pass. He was an elderly man (66 years of age), an experienced haulier, but had only been employed a few days at this colliery. It is one of a class of accidents due to the condition of the haulage road, not so much as to its size or security from falls of roof or sides, as to gradients and under foot conditions, which in many mines are unsatisfactory, and the cause of accidents.

A haulier, 18 years of age, while waiting for trams at a double parting in Celynen Colliery (Mon.), on the 18th April, was run over by some empty trams which were being drawn into the parting by a rope. The manner in which he got under the trams has never been satisfactorily explained.

A filler, 18 years of age, at Trafalgar Colliery (Forest of Dean), on the 22nd April, stood at the side of the road to allow a journey of trams to pass, and was fatally crushed by one of them, which got off the rails and caught him against the side. Man holes were provided, but he seems not to have considered it necessary to avail himself thereof.

A door minder, 66 years of age, at Lightmoor Colliery (Forest of Dean), on the 9th May, opening the door too late was caught by the trams and killed. This might have been classed under the heading of engine planes, quite as well as under this, either being correct.

A labourer, engaged repairing in one of the main haulage roads of Celynen Colliery (Mon.), on the 25th May, was crushed by a tram which, in consequence of not being properly spragged by the timbermen using it, ran wild and caught him. It was due to sheer neglect on the part of the timbermen.

A haulier, while shafting a tram, at Rhymney (Clay Level) Colliery (Mon.), on the 16th June, *i.e.*, letting it down an inclined place, having his back against the front, stumbled, and was run over by it. This is a practice which must not be allowed, being a "dangerous practice," any such being prohibited by the Special Rules.

A collier lad, while on his way out to the shaft from his work at Coalbrook Vale (Deep Pit) Colliery (Mon.), on the 22nd September, was crushed by a runaway tram, the result of carelessness. The iron pin for fastening the cross bar was missing, and the collier substituted a piece of wood, which broke when the haulier was getting the tram on the rails, and released it from control.

A coal filler was crushed in the double parting at the bottom of the engine plane, at Rudry (Homfrey's Level) Colliery (Glam.), on the 16th October, by some trams which had been drawn up into the incline, which is steep, becoming detached and running back.

On the Surface.

Ten accidents, which resulted in 10 deaths, occurred on the surface.

A coal loader at Blaenavon Collieries, on the 28th February, fell from a gangway leading between the Pit Bank and the screens, owing, it is thought, to there being ice on the gangway.

A haulier's head, on the 20th June, was fractured by his horse rearing and striking him.

A labourer at Camerton Colliery, on the 28th June, while assisting to tip a waggon of coal, stepped off the platform on to an adjoining wall, and fell about 9 feet, from the effects of which he died.

A haulier at Cwmbran Colliery, on the 2nd September, who rushed to grab the reins of his horse, missed them, and fell in front of the trams, with which the horse bolted.

A collier at Tredegar, on the 6th October, was crushed on the Branch Railway, when passing between railway waggons, on his way home from work.

A shunter at Blaina Collieries, on the 14th October, slipped and fell in front of railway waggons, which he was engaged in shunting.

The stoker of a locomotive at Glyn Colliery, on the 10th November, bringing empty waggons from the station to the colliery on the Branch Railway, jumped off the buffer in order to turn the points, and having missed his footing, fell in front of the trucks and was run over.

A waggon repairer at South Wales Colliery, on the 10th November, was crushed between the buffers of railway waggons on the Branch Railway sidings.

A shunter at Blaina Collieries, on the 19th December, was blocked between the buffers of railway trucks, near the screens, while lowering them for filling.

A collier at Blaina Collieries, on the 20th December, was improperly riding on the footboard of a collier's train going to work, and on arrival at the colliery was crushed against the platform.

Enforcement of the Act and Special Rules.

Magisterial Proceedings against Owners, Agents, and Managers.

I instituted proceedings during the year, with your sanction, in the following cases for contraventions of the Coal Mines Regulation Act, 1887.

On the 2nd October, at the Lawford Gate Police Court, Bristol, against the Manager of the Kingswood Colliery for not having the working places adequately ventilated. The case was heard before Messrs. F. Tothill, G. H. Pope, C. W. Savage, W. Butler, and G. Fussell, Justices of the Peace, and a fine of 5*l.* and costs imposed.

Mr. Thomas Parr, of Messrs. Osborne, Ward, Vassall and Co., conducted the case on my behalf, and Mr. Sibley, of Sibley and Dickinson, defended.

I laid informations for contraventions during the year against four other persons, but as they were not heard until January 1894, I do not propose returning them in this year's report.

Magisterial Proceedings on the part of Owners, &c. against Workmen.

With a view to enforcing the requirements of the Act and Special Rules, and relieving themselves of responsibilities which were considered to belong to the workmen, the Owners,

Agents, or Managers have instituted Magisterial proceedings against the offenders for the following contraventions, with the results stated, viz.:—

Name of Company.	Date and Place of Hearing.	Nature of Contravention and Rule.	Result.
	1893.		
The Coalbrook Vale Coal Co.	Mar. 10 Blaina -	Riding on engine plane without permission, and for illusing a horse - - - - S.R. 59 S.R. 62	Fined 38s. 6d.
	Apr. 7 " -	Neglecting to sprag - G.R. 22 & S.R. 66	" 20s.
	Dec. 31 " -	Illtreating a horse - - - S.R. 62	" 20s.
The Ebbw Vale Steel, Iron, and Coal Co., Ltd.	May 11 Ebbw Vale -	Sleeping in mine while in charge of a lighted safety-lamp - - S.R. 67	In default, committed for one month's imprisonment with hard labour.
The Foxes Bridge Colliery Co., Ltd.	Dec. 1 Little Dean	For entering part of the mine other than where he was employed, and in consequence of which he got injured S.R. 58	Costs 7s. 6d. Bound over to appear when called upon.
Lancaster's Steam Coal Collieries Co., Ltd.	May 6 Blaina -	Neglecting to sprag - G.R. 22 & S.R. 66	Fined 40s.
The Lydney and Crump-meadow Collieries Co., Ltd.	Dec. 29 Little Dean	Driving a needle through the stemming of a shot hole - - S.R. 72	" 10s.
The Newport Abercarn Black Vein Steam Coal Co., Ltd.	Jan. 20 Blackwood -	Disobeying the overman - - S.R. 54	" 20s. and 26s. 6d. costs.
	Feb. 17 " -	Two men for neglecting to sprag - - - G.R. 22 & S.R. 66	" 20s. each.
	" " -	Neglecting to sprag - G.R. 22 & S.R. 66	" 40s.
	Mar. 17 "	Sleeping in mine while in charge of a lighted safety-lamp - - S.R. 67	" 40s.
	May 12 " -	Illtreating a horse - - - S.R. 62	" 20s.
	Sept. 15 " -	Having a pipe in his possession in the mine - - - - S.R. 91	8s. 6d. costs
	" " -	Sleeping in mine while in charge of a lighted safety-lamp - - S.R. 67	Dismissed.
	Nov. 10 " -	Sleeping in mine while in charge of a lighted safety-lamp - - S.R. 67	Fined 40s.
Partridge, Jones, & Co., Ltd.	May 20 Pontypool -	Neglecting to sprag - G.R. 22 & S.R. 66	" 20s.
	" "	Sleeping in mine while in charge of a lighted safety-lamp - - S.R. 67	" 40s.
	Aug. 8 "	Having a pipe in his possession in the mine - - - - - S.R. 91	6s. costs.
	Dec. 11 "	Sleeping in mine while in charge of a lighted safety-lamp - - S.R. 67	Fined 20s.
Powell Duffryn Steam Coal Co., Ltd.	Apr. 4 Tredegar -	Two men for unramming a missed shot - - - - S.R. 72	" 40s. each.
	" 25 "	Sleeping in mine while in charge of a lighted lamp - - S.R. 67	14 days' imprisonment.
	May 23 "	Interfering with signals - - S.R. 57	Fined 40s.
	Sept. 12 "	Interfering with signals - - S.R. 57	" 40s. and 13s. 6d. costs.
Powell's Tillery Steam Coal Co., Ltd.	Mar. 10 Blaina -	Not placing his safety-lamp beyond the swing of his pick - - S.R. 94	" 40s.
	Oct. 20 " -	Interfering with banksman in pursuit his duties - - - S.R. 49	" 40s. and 8s. 6d. costs.
J. and W. Stone -	Jan. 20 " -	Leaving a door open underground - S.R. 67	" 20s.
	Mar. 10 " -	Neglecting to sprag - G.R. 22 & S.R. 66	" 40s.
	Oct. 20 " -	Leaving two door open underground - - - - S.R. 67	" 20s. and 6s. 6d. costs.
The Tredegar Iron & Coal Co. Ltd.	Oct. 21 " -	Leaving ventilating doors open - S.R. 67	" 20s.
The United National Collieries, Ltd.	June 23 Blackwood	Two men for having matches in their possession in the mine - - S.R. 91	" 40s. and 12s. 6d. costs each.
J. Vipond & Co., Ltd. -	Dec. 9 Pontypool	Neglecting to sprag - - - S.R. 66	" 20s.

List of Apologies.

In lieu of magisterial proceedings, the Mines Executives have in the cases given below accepted (with payments of cost of printing and donations to some institution or benevolent fund) apologies, which were printed and posted up at the works as a warning to others.

Private fines are deducted from the men's wages at some mines, which I do not consider a satisfactory enforcement of the legal requirements, as the object of dealing with contraventions should be to prevent any repetition, and this is best attained by publicity, besides which such deductions are illegal. Apologies should, if they prove insufficient to attain the object, be strengthened from time to time by taking cases before the Justices, who usually, in my district, with good results, practically show their appreciation of the efforts of the officials to enforce compliance with the rules established for the safe working of the mines.

This is, however, not considered by the officials to be the case in some of the courts in which cases are taken against workmen, for contraventions of the Act and Special Rules. This disheartens them in their efforts on behalf of the safety of their men themselves, and respecting which they say they are being continually worried by the Inspectors.

Name of Company.	Date.	Nature of Contravention and Rule.	Amount paid to some Institution or Benevolent Fund.
	1893.		s. d.
The Coalbrook Vale Coal Co.	March 2	Two men for neglecting to sprag G.R. 22 & S.R. 66	—
	November 22	Returning to a missed shot S.R. 18	—
	" 27	Leaving hauling engine while in motion S.R. 40	—
The Coalpit Heath Co.	January 2	Neglecting to sprag G.R. 22 & S.R. 66	2 6
	April 17	" " G.R. 22 & S.R. 66	2 6
	July 14	" " G.R. 22 & S.R. 66	2 6
The Ebbw Vale Steel, Iron, and Coal Co., Ltd.	June 12	Not having watched over the safety of a boy employed with him S.R. 22	5 0
	October 9	For storing loose powder in the mine G.R. 12	—
	December 12	Neglecting to sprag G.R. 22 & S.R. 66	—
The Kingswood and Parkfield Collieries Co. Ltd.	November 22	Refusing to leave the cage at the pit bottom S.R. 57	—
The London and South Wales Coal Co., Ltd.	June 24	Leaving a ventilating door open S.R. 67	10 0
Partridge, Jones, & Co. Ltd.	May 6	Two men for neglecting to sprag G.R. 22 & S.R. 66	1 0 each
J. Vipond and Co., Ltd.	" 5	Not having watched over the safety of a boy employed with him S.R. 65	—

RELATING TO MANAGERS' AND UNDER MANAGERS' CERTIFICATES.

The Board of Examination for Managers' and Under Managers' Certificates of Competency under the Coal Mines Regulation Act consists of:—

Owners of Mines.

E. Broderip, Esq., Cossington Manor, Bridgwater, Chairman.
E. Jones, Esq., Snatchwood House, Pontypool, Vice-chairman.
T. H. Deakin, Esq., Parkend, Glos.

Mining Engineers.

W. Morgans, Esq., The Guildhall, Bristol.
J. T. Green, Esq., Abercarn, Monmouthshire.
Robert Jordan, Esq., Clytha Park, Newport, Monmouthshire.

Working Miners.

Mr. A. Cullen, 2, Norwood Terrace, Coleford, near Bath.
Mr. W. Steadman, Ebbw Vale, Monmouthshire.
Mr. D. Williams, Rhymney, Monmouthshire.

H. M. Inspector of Mines.

Joseph S. Martin, Esq., Durdham Park, Bristol.

Secretary.

Sydney J. Thomas, Esq., Coleford, Gloucestershire.

There has been no change in the constitution of the board during the year.

Mr. R. Abraham was again appointed an examiner, along with Messrs. Morgans and Green, members of the board, who conducted the examination, Mr. Abraham having obtained an appointment in Glamorganshire, withdrew from the examinership without giving sufficient notice to allow of another being appointed.

The examinations were held in Newport on the 5th, 6th, and 7th of September for managers' certificates, when 11 candidates presented themselves, two of whom were reported as having qualified; and on the 12th, 13th, and 14th of September for under managers' certificates, when 39 candidates attended, of whom 24 were reported to have qualified.

The questions will be found appended. The standard of qualification which the board considers colliery managers should possess is indicated by publishing the questions. There is also a *vivâ voce* examination to further test the candidates' knowledge of practical mining.

The publication of the questions for each district would prevent the same questions being used at a future examination, as has been done, and would on several grounds be distinctly

advantageous. It would also tend to bring about a more uniform standard, which is most essential, so much so that I advocate one central board of examiners. The present system is unsatisfactory, as each board has an independent standard of qualification.

The following table shows the number of candidates examined and the numbers of those who qualified for certificates from the year 1873 down to and including the examination in 1893 in this district.

Managers (1st Class).

Date.	Number of Candidates.	Number Passed.	Date.	Number of Candidates.	Number Passed.
1873, July - -	11	5	1882, July - -	10	6
„ December - -	4	1	1883, „ - - -	14	8
1874, July - - -	7	5	1884, „ - -	12	6
„ December - -	8	5	1885, „ - - -	26	7
1875, July - - -	17	9	1886, „ - -	19	7
1876, „ - - -	11	4	1887, „ - - -	20	6
1877, „ - - -	9	7	1888, „ - -	7	4
1878, „ - -	9	6	1889, „ - - -	9	4
1879, „ - - -	11	6	1890, „ - -	10	5
1880, „ - - -	13	10	1891, September - -	9	4
1881, „ - -	9	5	1892 „ - -	13	3
1881, December - -	13	7	1893 „ - -	11	2

Under Managers.

Date.	Number of Candidates.	Number Passed.
1888, July - -	44	36
1889, „ - - -	24	14
1890, „ - -	24	9
1891, September - -	25	13
1892, „ - -	35	15
1893, „ - -	39	24

TABLE showing where the CANDIDATES for MANAGERS' CERTIFICATES under this BOARD came from.

—	1886.		1887.		1888.				1889.				1890.				1891.				1892.				1893.			
	1st Class.		1st Class.		1st Class.		2nd Class.		1st Class.		2nd Class.		1st Class.		2nd Class.		1st Class.		2nd Class.		1st Class.		2nd Class.		1st Class.		2nd Class.	
	Candidates.	Passed.	Candidates.	Passed.	Candidates.	Passed.	Candidates.	Passed.	Candidates.	Passed.	Candidates.	Passed.	Candidates.	Passed.	Candidates.	Passed.	Candidates.	Passed.	Candidates.	Passed.	Candidates.	Passed.	Candidates.	Passed.	Candidates.	Passed.	Candidates.	Passed.
Glamorganshire -	13	5	12	3	5	3	10	10	4	2	6	4	5	3	7	4	2	1	5	3	8	—	19	8	4	—	14	8
Gloucestershire (Bristol) - -	—	—	—	—	—	—	1	—	—	—	1	1	1	—	—	—	—	—	—	—	2	1	—	—	—	—	—	—
Gloucestershire (Forest of Dean) -	—	—	1	1	1	1	8	6	2	—	2	2	—	—	2	1	1	1	6	1	—	—	3	—	1	—	7	3
Monmouthshire -	6	2	6	2	1	—	19	15	2	1	13	5	4	2	11	3	5	2	12	8	2	1	11	7	4	—	15	10
Somersetshire -	—	—	—	—	—	—	6	5	1	1	2	2	—	—	4	1	1	—	1	1	—	—	1	—	1	1	1	1
Yorkshire - -	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1	—	—	—	—	—	—
Flintshire (Ruabon)-	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—
Lancashire - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	1	1	2	2
Totals - - -	19	7	20	6	7	4	44	36	9	4	24	14	10	5	24	9	9	4	25	13	13	3	35	15	11	2	39	24

EXAMINATION PAPERS FOR MANAGERS' CERTIFICATES OF COMPETENCY, SEPTEMBER 1893.

No. 1. Subject—Arithmetic.

(20 *marks for each question.* 60 *marks to qualify.*)

1. Simplify the following expression, and word out its value to two places of decimals :—

$$\sqrt[2]{\frac{2467 \times 3\frac{7}{8} - 43\cdot125}{145}}$$

2. A colliery produces, per week, 6,500 tons of large coal, and 1,250 tons of small. The wages cost on the total output is 3*s.* $4\frac{1}{2}$*d.* per ton. What is the cost per ton of the large coal when it is debited with the entire wages expenditure, and credited with the value of the small coal at 2*s.* $10\frac{1}{2}$*d.* per ton ?
3. A contractor delivers coal at pit bank at the rate of 4*s.* 3·85*d.* per ton. What rates should he be paid (*a*) at an advance of $13\frac{1}{4}$ per cent., (*b*) at a reduction of $5\frac{3}{4}$ per cent. on the above rate ?
4. An engine makes 35 revolutions per minute. The stroke is 5 feet. Give the ratio between the travel of the piston and the movement of the crank-pin for each revolution, and the total number of feet which the crank-pin moves in $1\frac{5}{7}$ seconds.
5. In a colliery where the faces or roads are driven 9 feet wide, and rectangular pillars, of 21 feet by 12 feet, are left for support; what per-centage of the seam is removed, and what is the per-centage increased to by driving a 9 feet road through the breadth of each pillar ?

No. 2. Subject—Surveying and Geology.

(20 *marks for each question.* 80 *marks to qualify.*)

1. Explain what is understood by the terms "true north" and "magnetic north," and and how each is ascertained.
2. Explain what steps you would take for connecting an underground survey with a surface plan, so as to secure their true relationship.
3. Give examples to show your method of booking observations in a survey book and in a Level book.
4. State what comparisons you can make between the strata of the South Wales Coalfield and the Bristol Coalfield.
5. (*a.*) What are the characteristics of the Millstone grit formation. (*b.*) Illustrate, by a sketch, the relative positions of the Millstone grit, the Mountain limestones, and the Coal Measures.
6. Write down in order the systems of rocks from the Lias to the Silurian.

No. 3. Subject—Gases and Ventilation.

(20 *marks for each question.* 100 *marks to qualify.*)

1. Describe the chemical and physical properties of air.
2. Describe the construction and action of a maximum and minimum thermometer, and give a sketch of the instrument.
4. Would the graduation of the tube of a thermometer be affected by altering the capacity of the bulb ? Give the reason for your answer.
4. The total ventilating pressure on an underground door is 390 lbs., with a water gauge of 2·5 inches. Give the height and width of a door satisfying these conditions.
5. (*a.*) What steam-driven mechanical ventilator would you employ for obtaining 150,000 cubic feet of air per minute in a mine with a water gauge of 1·75 inches at the ventilator ?
   (*b.*) What power would you expect the engine to indicate to produce the above result ?
   (*c.*) What would be the efficiency of the ventilating mechanism ?
6. Describe the composition and properties of firedamp, and show what chemical change takes place when a mixture of firedamp and air is exploded.
7. What is required by the Coal Mines Regulation Act as to the ventilation of mines, and how could you satisfy yourself that the Act is complied with in a colliery ?
8. What is the use of air crossings, and how would you construct one ?

No. 4. Subject—Practical Mining.

(20 *marks for each question.* 100 *marks to qualify.*)

1. Describe the provisions of the Coal Mines Regulation Act with regard to the duties of managers and under managers.
2. Draw a section of the coal, floor, and roof of any seam worked in a colliery you are acquainted with, and explain the method of working the coal and of ventilating the colliery.
3. Illustrate, by sketches, what you consider to be the most convenient and best arrangement of pit-bottom roads and sidings for a colliery drawing 600 tons of coal in 9 hours, from a depth of 450 yards.
4. Some underground workings are very liable to take fire by spontaneous ignition. How is it explained?
5. Where is the best place for placing the water gauge for ascertaining the ventilating pressure at a fan drift? Give your reason, and illustrate your answer by a sketch showing the position of the water gauge.
6. In what way might underground hauling engines, driven by compressed air, cause a danger of fire, and how is the danger to be guarded against?
7. Describe the precautions necessary for driving an underground road to meet a point in old workings plotted from magnetic surveys 20 years ago.
8. How would you conduct shot firing in dry and dusty workings where firedamp sometimes occurs?

No. 5. Subject—Colliery Plant and Machinery.

(20 *marks to each question.* 60 *marks to qualify.*)

1. A 30-H.P. Lancashire boiler, used at a colliery, has to be carefully examined and then tested. Describe how you would make the examination and test.
2. Describe the action of the Cornish type of pumping engine.
3. Draw a sketch showing a transverse section of a good design of pit-head pulley for carrying a wire rope of $3\frac{3}{4}$ inches circumference, bearing a 5-ton load. The sketch should not be less than 4 inches in length, and should be neatly finished. The candidate should specify below the sketch the material or materials of which the pulley should be made, and the method of securing the arms to the rim and the boss.
4. It is necssary to transmit mechanical power from the surface of a colliery down a shaft and into the workings by the agency of electricity, so as to obtain 10-H.P., effective, from a hauling engine underground. Explain how this should be done, and ennumerate the appliances necessary for the installation. State, also, how much power you would provide at the surface to supply the 10-H.P., effective, at a total distance of 1,000 yards, including the depth of the shaft.
5. Explain how a steam engine is indicated.
6. Give two examples to show the practical usefulness of indicator diagrams.

EXAMINATION PAPERS FOR UNDER MANAGERS' CERTIFICATES OF COMPETENCY. SEPTEMBER 1893.

No. 1. Subject—Arithmetic.

(20 *marks for each question.* 60 *marks to qualify.*)

1. How much money is required to pay the following daywork wages to five men, and what is each man's share?

				s.	*d.*	
1st	man,	4	days, at	4	6	per day.
2nd	,,	$5\frac{3}{4}$	,, ,,	5	0	,,
3rd	,,	6	,, ,,	4	3	,,
4th	,,	$2\frac{1}{4}$	,, ,,	4	2	,,
5th	,,	$3\frac{1}{2}$	,, ,,	3	11	,,

2. The week's wages of a company of miners at the standard rate amounts to 15*l.* 10*s.* What will the wages amount to at an advance of $27\frac{1}{2}$ per cent. on the standard?

3. A collier receives 2*l.* 4*s.* for getting and filling 24 tons of coal. He has to pay 5*d.* per ton for filling. How much per ton does he receive for getting?
4. How many 9-feet lengths of rails would be required for laying a tramway 270 yards long?
5. A tank, which measures 3 feet square and 3 feet deep, is full of water. How many pounds of water does the tank hold, allowing each cubic foot of water to weigh 62½ pounds.

No. 2. Subject—Gases and Ventilation.

(20 *marks for each question.* 60 *marks to qualify.*)

1. What are the most dangerous gases commonly met with in collieries? Why are they dangerous? Which of the gases have you had most experience with underground?
2. Explain your views as to what effect a heavy fall of the barometer has upon the condition of a mine.
3. How would you measure the velocity of a current of air passing through an air-course?
4. What would you do to examine working places in which accumulations of carbonic acid gas might be expected to exist?
5. What size would you drive an air-way to pass 10,000 cubic feet of air per minute, at a velocity of 4 feet per second?

No. 3. Subject—Practical Mining.

(20 *marks for each question.* 120 *marks to qualify.*)

1. What are the responsibilities and duties of an under manager in the absence of the manager?
2. What are the requirements of the Coal Mines Regulation Act as to ventilation?
3. What steps should an under manager take regarding a collier who neglected to properly sprag his coal?
4. What matters should be attended to in order to secure safety in sinking shafts?
5. How would you deal with shots which have missed fire?
6. Describe the method and precautions you would adopt for driving a road through a heavy fall of roof.
7. Under what circumstances are "cogs" useful in underground workings?
8. What are the signs sometimes met with in coal faces, and which should serve as warnings that old goaves or old workings are near?
9. How would you put up a safety door, or a reserve door, to be available directly after a severe explosion had happened?
10. If a collier was badly injured, internally but not killed, in his working face, what steps would you take to insure the best means of saving his life?

I append the schedule of fatal accidents, which this year includes the whole of the accidents which were formerly divided under the headings of (A. and B.) and (C.), the former being those which occurred in and about the mines of the kingdom, as collated since 1873 or earlier, while the latter (C.), were the accidents which occurred on the branch railways, washing and coking establishments, away from the collieries, although belonging to the same owners.

These (C.) accidents have only been tabulated since 1888, and considerable doubt exists in the minds of some whether they are comprised under the Coal Mines Regulation Act, 1887, and whether the Act in any way refers to the working arrangements, or returns of persons employed or accidents occurring at these works.

I beg, as before, to submit my report under the Metalliferous Mines Regulation Act, 1872, along with this.

I have, &c.
JOSEPH S. MARTIN,
H.M. Inspector of Mines.

To the Right Hon. Herbert H. Asquith, Q.C., M.P.,
H.M. Principal Secretary of State
Home Department,
Whitehall, London.

MINES CLASSED UNDER THE COAL MINES REGULATION ACT.

FATAL ACCIDENTS, and DEATHS arising therefrom within ONE YEAR and a DAY from the DATE of the ACCIDENT, during the Year 1893.

No. of Accident.	Date.	Hour of the Person's Shift, i.e., No. of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost.					
										Explosions of Firedamp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous. Underground.	Above-ground.	Total.
1	1893. Jan. 4	7th	Writhlington Foxcote.	Radstock - - (Somersetshire.)	The Writhlington, Huish, and Foxcote Colliery Co.	Walter Bendle -	16	Carting lad	Fall of roof in the New Vein. It occurred immediately in front of the roadway beyond the point to which the roof had been ripped, and 3 or 4 yards back from the face of the coal. It was about 9 inches thick, and was released at the top and three sides by slips. There were several props close around the edge of it, but by the use of "collars" or "crown trees," it could have been secured. These slips are not frequent at this mine.	–	1	–	–	–	1
2	,, 12	1st	Parkfield -	Mangotsfield - (Gloucestershire.)	The Kingswood and Parkfield Collieries Co., Limited.	William Bryant - Thomas Thompson	60 56	Collier - ,, -	Fall of clod. It fell over upon them owing to an unseen slip at the back, and discharged two sprags, which they had set before commencing to hole the coal.	–	2	–	–	–	2
3	,, 13	10th	Cwmbran -	Cwmbran - (Monmouth.)	The Patent Nut and Bolt Co., Limited.	Thomas Morgan - Frederick Hamblin	40 14	Timberman Collier's boy	Fall of roof. While engaged replacing timbers on a roadway, a fall occurred before they got the new ones properly tightened up, lagged, and weighted, which discharged them upon the deceased. As it occurred at the close of the shift, and after the haulier had taken out the last tram, the occurrence was	–	2	–	–	–	2

List of Fatal Coal Mine Accidents—*continued.*

No. of Accident.	Date.	Hour of the Person's Shift, i.e., No. of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Firedamp.	Lives lost. Falls of Roof and Sides.	Lives lost. In Shafts.	Lives lost. Miscellaneous. Underground.	Lives lost. Above-ground.	Lives lost. Total.
	1893.								unknown for 3 or 4 hours, when, in consequence of their not returning home, search was made. The boy was still alive when his father and the examiner reached the place, but died before they were able to release him.						
4	Feb. 1	7th	Celynen -	Abercarn - - (Monmouth.)	Newport Abercarn Black Vein Steam Coal Co., Limited.	Isaac Stephens -	33	Collier -	Suffocated by firedamp which accumulated in a hole in the roof at the side of a stall road where a fall 8 or 9 feet high had occurred two months previously. The place was ventilated by a sheet across the road, and it is alleged was clear when examined on the morning of the accident and that there had not been any firedamp found there for some time back. He was employed with an old and experienced repairer on the stall road about 50 yards distant, ripping roof. He had lost a shovel a week or so before, and is supposed to have been looking for it.	–	–	–	1	–	1
5	„ 7	1st	New Rock -	Radstock - (Somersetshire.)	The New Rock Coal Co.	Edward Emery -	36	Brancher -	He was filling squibs preparatory to blasting, and while so engaged, sitting with two or three of his comrades, a spark flew from one of their candles into the powder and ignited it. One of the others was also injured, but he recovered.	–	–	–	1	–	1

List of Fatal Coal Mine Accidents—*continued.*

No. of Accident.	Date.	Hour of the Persons' Shift, *i.e.*, No. of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Firedamp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous. Underground.	Above-ground.	Total.
6	1893. Feb. 18	5th	Waun Llwyd	Ebbw Vale - (Monmouthshire.)	The Ebbw Vale Steel, Iron, and Coal Co., Limited.	Joseph Roberts -	44	Collier -	When at work ripping roof with a pick, a small piece of stone in falling caught his wrist; he continued his shift out, and worked some days afterwards, but complained of his hand being stiff. He ceased work after about a week, and died on the 23rd December, 10 months afterwards. He was a member of the Permanent Relief Society, and apparentfy drew relief pay from it for 43 weeks, and his widow, I understand, gets 5*s.* a week for herself, and 2*s.* 6*d.* each for three children, being 12*s.* 6*d.* a week. The cause of death is certified to by the club doctor as the result of blood poisoning supervening upon the injuries received to his wrist. The matter has been much commented upon by medical men and others, who consider that death was from other causes. I have included it as a mining accident, but was not aware that blood poisoning continued its effects so long.	–	1	–	–	–	1
7	„ 28	2nd	Blaenavon - (Big Pit.)	Blaenavon - (Monmouth.)	The Blaenavon Co., Limited.	George Turner -	13	Picking slag on railway trucks.	Fell about 16 feet, from a gangway leading from the pit bank down to the screens. It was covered with ice at the time, but had a hand rail at each side.	–	–	–	–	1	1

List of Fatal Coal Mine Accidents—*continued.*

No. of Accident.	Date.	Hour of the Person's Shift, i.e., No. of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Firedamp.	Lives lost. Falls of Roof and Sides.	Lives lost. In Shafts.	Lives lost. Miscellaneous Underground.	Lives lost. Above-ground.	Lives lost. Total.
8	1893. Mar. 9	5th	White R Level.	New Tredegar - (Monmouth.)	The Powell Duffryn Steam Coal Co., Limited.	David Evans -	66	Haulier -	Found dead on the main roadway, 20 or 30 yards behind the trams which he was taking out, and which were found to be off the rails on an inclined part of the road. He would seem to have been trying to put sprags into the wheels near the top of this steep part, and to have in some manner stumbled in front of the trams, which passed over him. He was, it seems, an old and experienced haulier, although only employed three or four days on this road. The horse was a quiet and steady one.	–	–	–	1	–	1
9	„ 11	1st	Elliot -	New Tredegar - (Monmouth.)	The Powell Duffryn Steam Coal Co., Limited.	John Williams -	48	Stoneman -	Fall of roof from slips, where a large opening was being made for arching near the bottom of the West Shaft, preparatory to the erection of a pumping engine. He had only just relieved the previous shift, the men of which had not left when it occurred. He was engaged continuing the drill hole commenced by one of them under this stone.	–	1	–	–	–	1
10	„ 14	4th	Llanerch -	Pontypool - (Monmouth.)	Partridge, Jones, and Co., Limited.	William Matthews	48	Collier -	Fall of roof at the coal face. It dropped out from between props in consequence of joints which ran across the place.	–	1	–	–	–	1

List of Fatal Coal Mine Accidents—*continued.*

No. of Accident.	Date.	Hour of the Person's Shift i.e., No. of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Firedamp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above-ground.	Total.
11	1893. April 18	2nd	Celynen -	Abercarn - (Monmouth.)	The Newport Abercarn Black Vein Steam Coal Co., Limited.	Henry Hughes -	18	Haulier -	Run over by the empty journey at the double parting, into which they were being drawn by the haulage arrangements (main and tail rope). How it actually occurred, or the cause for it, is not clearly explained.	–	–	–	1	–	1
12	„ 22	10th	Ty Trist - (No. 2 Pit.)	Tredegar - - (Monmouth.)	The Tredegar Iron and Coal Co., Limited.	Frank Pagett -	26	Collier -	Fall of coal and clod at the working face while engaged holing. The result of insufficient spragging.	–	1	–	–	–	1
13	„ 22	3rd	Trafalgar -	Drybrook - (Forest of Dean.)	The Trafalgar Colliery Co., Limited.	George Bitey	18	Filler -	Crushed by a tram or "cart" against the side of the road. It appears to have got off the rails just as it was passing him.	–	–	–	1	–	1
14	„ 28	9th	New Tredegar	New Tredegar - (Monmouth.)	The Powell Duffryn Steam Coal Co., Limited.	John Lewis -	40	Collier -	Fell from the cage while ascending. He and others having reached the shaft after the cage had been signalled away, got in, contrary to the Special Rules, and upon the cage being drawn up he seems to have fallen out. It is a large roomy cage, but apparently he cannot have got settled in before the cage was drawn up, and probably some of his clothes caught in the guides or byatts, &c.	–	–	1	–	–	1

List of Fatal Coal Mine Accidents—*continued.*

No. of Accident.	Date.	Hour of the Person's Shift, i.e., No. of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Firedamp.	Lives lost. Falls of Roof and Sides.	Lives lost. In Shafts.	Lives lost. Miscellaneous. Underground.	Lives lost. Above-ground.	Lives lost. Total.
15	1893. May 9	3rd	Lightmoor -	Cinderford - (Forest of Dean.)	H. Crawshay & Co., Limited.	Joseph Hopkins -	68	Door Minder	Run over by a journey of carts or trams on the engine plane, where he was in charge of a door. He went to open the door on the approach of the journey, but miscalculated its distance, and did not close in time. The door was carried away, and he was fatally injured.	–	–	–	1	–	1
16	" 25	5th	Celynen -	Abercarn - (Monmouth.)	The Newport Abercorn Black Vein Steam Coal Co., Limited.	Robert Ash -	57	Labourer -	Knocked down and fatally injured by a tram which two timbermen were using on an inclined part of the North Engine Plane, they having failed to adequately sprag it.	–	–	–	1	–	1
17	" 28	3rd	Foxesbridge -	Cinderford - (Forest of Dean.)	The Foxes Bridge Colliery Co., Limited.	Henry Million - Edward Bowkett - Thomas Mountjohn	56 45 41	Shaftman - " - " -	Fell part way (150 yards) down the shaft, in consequence of the breakage of the bridle chains of the cage on which they were ascending. They, with another man (who escaped by clutching the guides), were employed in the shaft at pump repairs. Having had the cage out of the "rake," for the purpose of getting to the pumps, they omitted to properly steady it before signalling to be drawn up to the surface. There were two wire-rope guides or conductors for the cage, which, being somewhat slack, allowed of oscillation, resulting in the cage catching under the end of the	–	–	3	–	–	3

List of Fatal Coal Mine Accidents—*continued.*

No. of Accident.	Date.	Hour of the Person's Shift, i.e., No. of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Firedamp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous. Underground.	Above-ground.	Total.
	1893.								spindle for working the top "kep clack" of the pump, and the consequent snapping of the chains. Four wire rope guides have been applied to the cage since, and the spindle has also been shortened.						
18	June 3	6th	New Tredegar	New Tredegar - (Monmouth.)	The Powell Duffryn Steam Coal Co., Limited.	Daniel James Welsh	16	Collier -	Fall of roof in the Yard Vein. Result of insufficient timbering. There are numerous slips in this roof, and in this case, although the officials had been in the place during the shift, they appear to have taken no particular notice, and might as well not have been there. I was much dissatisfied with the supervision in this case.	–	1	–	–	–	1
19	" 13	4th	Varteg Hill -	Varteg - - (Monmouth.)	J. Vipond and Co., Limited.	Ernest Davies -	21	Collier -	Fall of roof from slips in the Elled Seam. He was alone when it occurred, having sent his boy home, as the pit was not drawing coal. The big coal lies about 6 feet under the Elled, and is worked in advance of it, consequently the roof is more or less shaken in places, and slips affected accordingly. He had fired a shot in the coal, and before he could effectually secure the stone (even had he been aware of the slips), he must remove some of the coal, which he appears to have been doing.	–	1	–	–	–	1

List of Fatal Coal Mine Accidents—*continued.*

No. of Accident.	Date.	Hour of the Person's Shift, i.e., No. of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Firedamp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous. Underground.	Above-ground.	Total.
20	1893 June 16	10th	Rhymney - (Clay Level.)	Rhymney - - (Monmouth.)	The Rhymney Iron Co., Limited.	William Owen -	20	Haulier -	Run over by a tram which he appears to have stumbled in front of while "shafting," or going in front of it while letting it down a road dipping 3 inches in the yard.	–	–	–	1	–	1
21	" 20	1st	Tranch -	Pontnewynydd - (Monmouth.)	The Tranch Colliery Co.	Thomas Bryant -	31	Haulier on surface.	On the surface. His horse reared, and struck him on the head with his hoof, fracturing his skull.	–	–	–	–	1	1
22	" 28	10th	Camerton -	Camerton - (Somerset.)	Miss A. M. Jarrett -	James Edwards -	66	Surface labourer.	On the surface. When helping to tip a tram he stepped on to a small wall at the side, and slipping, fell about 9 feet to the ground, which resulted in his death.	–	–	–	–	1	1
23	July 20	10th	South Wales - (No. 2 Pit.)	Cwmtillery - (Monmouth.)	Lancaster's Steam Coal Collieries, Limited.	Frederick Rabbits-	21	Collier -	A large fall of roof at the face. It came from a joint and a false bed above. He was working alone, and occurring at the end of the shift, he was not missed for two or three hours. He was found dead under the corner of the fall near the tram road.	–	1	–	–	–	1

List of Fatal Coal Mine Accidents—*continued.*

No. of Accident.	Date.	Hour of the Person's Shift, *i.e.*, No. of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Firedamp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous. Underground.	Above-ground.	Total.
24	1893. Aug. 1	9th	Blaina - (Henwain Pit.)	Blaina - - (Monmouth.)	John Lancaster & Co., Limited.	John Walton -	27	Collier -	Fall of rock roof in Elled Seam from unseen slips. This is another Elled accident, and demonstrates that there evidently is need for the use of more timber in this seam, however satisfactory the roof may appear. There is no reason why the timber should not be set in these places as if the roof was bad, and thus obtain security.	–	1	–	–	–	1
25	" 23	6th	Kingswood - (Speedwell Pit.)	Bristol - - (Gloucestershire.)	The Kingswood and Parkfield Collieries Co., Limited.	Thomas Amos -	39	Collier -	Having fired a shot, he was clearing the coal to the place for loading into trams, when a quantity of small and soft coal (20 to 30 cwt.) fell from the face, extinguishing his light and covering him up. His brother, who worked with him, obtained assistance without delay, and he was soon got from under the coal, but life was then extinct. The ventilation was totally inadequate (*see* Prosecutions, page 18), and it is quite probable that had it been otherwise the lights would not all have been extinguished, and that with earlier help and fresh air he might have revived.	–	1	–	–	–	1

List of Fatal Coal Mine Accidents—*continued.*

No. of Accident.	Date.	Hour of the Person's Shift, i.e., No. of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Firedamp.	Lives lost. Falls of Roof and Sides.	Lives lost. In Shafts.	Lives lost. Miscellaneous Underground.	Lives lost. Above-ground.	Lives lost. Total.
26	1893. Sept. 2	5th	Cwmbran -	Cwmbran - (Monmouth.)	The Patent Nut and Bolt Co., Limited.	Thomas Powell -	68	Haulier -	On the surface. His horse apparently took fright, and bolted with the trams to which it was hitched. In trying to stop the horse he was run over by the trams and killed.	–	–	–	–	1	1
27	„ 4	4th	New Duffryn-	Rhymney - - (Glamorgan.)	The Rhymney Iron Co., Limited.	Owen Davies -	58	Repairer -	Fall of roof, where he and others were engaged repairing and enlarging the road at the turn from the engine plane into No. 4, West Level. They had got down the bed of stone under this one in order to make height. Probably it was somewhat drawn, and it fell while they were engaged filling up the rubbish.	–	1	–	–	–	1
28	„ 7	7th	Sirhowy - (No. 1 Pit.)	Sirhowy - - (Monmouth.)	The Ebbw Vale Steel, Iron, and Coal Co., Limited.	Thomas Redman -	47	Collier -	Fall of roof clod. It fell near the face from unseen slips, having been loosened by the vibration caused from wedging down some coal close to it.	–	1	–	–	–	1
29	„ 7	10th	Rhymney -	Rhymney - - (Monmouth).	The Rhymney Iron Co., Limited.	William Rees -	45	Collier -	Fall of roof coal from slips. He was holding a light for his comrade, who was knocking out a prop 2 or 3 yards lower down in the roadway. They all thought he was in a perfectly safe place, and so should I have thought so.	–	1	–	–	–	1

List of Fatal Coal Mine Accidents—*continued.*

No. of Accident.	Date.	Hour of the Person's Shift, *i.e.*, No. of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Firedamp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous. Underground.	Above-ground.	Total.
30	1893. Sept. 8	1st	Glyn - -	Pontypool - (Monmouth.)	The Bryndû Coal and Coke Co., Limited.	William Tanner -	32	Collier -	Fall of coal from the face directly after he commenced work. Result of inadequate spragging.	–	1	–	–	–	1
31	„ 15	1st	Bedwellty -	Tredegar - - (Monmouth.)	The Tredegar Iron and Coal Co., Limited.	James Hough -	28	Haulier -	Fall of roof in a main horse road. He, the master haulier, and another man, were riding together in an empty tram, when it struck one of the uprights which it discharged with others; a fall resulted and caused his death and injured the other two men.	–	1	–	–	–	1
32	„ 19	3rd	Kingswood - (Speedwell Pit.)	Bristol - - (Gloucestershire.)	The Kingswood and Parkfield Collieries Co., Limited.	Stephen Cains -	63	Collier -	The heading took a weight and squeezed out the higher side timbers and pack (in steep measures). They came in suddenly, and fastened him so that he could not escape. They were unable to extricate him for 12 hours, when he was found to be dead.	–	1	–	–	–	1
33	„ 22	10th	Coalbrook Vale (Deep Pit.)	Nantyglo - - (Monmouth.)	The Coalbrook Vale Colliery Co., (J. G. and W. Barnes.)	William Brown -	14	Collier -	In consequence of carelessness on the part of a haulier, a tram ran wild down an inclined road, along which he (deceased) and a collier were proceeding towards the shaft, and killed him.	–	–	–	1	–	1
34	„ 25	6th	Blaina - (Griffin No. 2 Pit.)	Blaina - - (Monmouth.)	John Lancaster & Co., Limited.	Thomas Harris -	40	Collier -	Fall of roof while holing. It fell close to the face from unseen slips. The place was fairly well timbered.	–	1	–	–	–	1

List of Fatal Coal Mine Accidents—*continued*.

No. of Accident.	Date.	Hour of the Person's Shift, *i.e.*, No. of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost.					
										Explosions of Firedamp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous. Underground.	Above-ground.	Total.
35	1893. Oct. 6	10th	Ty Trist -	Tredegar - - (Monmouth.)	The Tredegar Iron and Coal Co., Limited.	David Worthington	17	Collier -	On the surface. Crushed between railway trucks while crossing the colliery sidings on his way home from work.	–	–	–	–	1	1
36	„ 14	3rd	Blaina - (Lower Deep Pit.)	Blaina - - - (Monmouth.)	John Lancaster & Co., Limited.	William Rees -	48	Shunter on branch railway.	On the surface. He appears to have stumbled or fallen in front of the railway trucks, which he was engaged in shunting, and was run over.	–	–	–	–	1	1
37	„ 16	2nd	Rudry - (Homfray's Level.)	Caerphilly - (Glamorgan.)	The Rudry Merthyr Steam and House Coal Colliery Co., Limited.	John Harris -	17	Coal filler -	Some bungling occurred with regard to the coupling of the trams going up the engine plane, which is steep, so that, upon being drawn up a few yards, some of them ran back and caught him in the double parting, where he was standing near the bottom.	–	–	–	1	–	1
38	„ 17	2nd	Waun Llwyd	Waun Llwyd - (Monmouth.)	The Ebbw Vale Steel, Iron, and Coal Co., Limited.	Robert Williams -	15	Collier -	Fall of coal from the face. The collier had drawn down a large piece of coal, and the boy was picking slag from it, when a further lump rolled over and caught him.	–	1	–	–	–	1

List of Fatal Coal Mine Accidents—*continued.*

No. of Accident.	Date.	Hour of the Person's Shift, *i.e.*, No. of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost.					
										Explosions of Firedamp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous. Underground.	Above-ground.	Total.
39	1893. Oct. 20	1st	Blaina (Henwain Pit.)	Blaina (Monmouth.)	John Lancaster and Co., Limited.	Charles Bolter	29	Hitcher	A piece of coal fell from the cage, which was being banked, and caught him on the head just as he was engaged hitching at the bottom. I only wonder that this class of accident is not more frequent.	–	–	1	–	–	1
40	„ 26	6th	Tir Pentwys	Pontypool (Monmouth.)	The Tir Pentwys Black Vein Steam Coal and Coke Co., Limited.	John Richards	47	Sinker	There were five men in the bottom of the sinking pit lighting shots, and having done so they got into the kibble or "bowk," and signalled to be wound up. While doing so the signal rope broke, and as the engine-man paused before starting to wind up, they were about to get out to extract the fuzes from the holes. Richards and a man named Matthews had got out when the engine-man commenced drawing up the kibble or "bowk"; he then caught the side of the kibble, which was drawn up about 40 yards before they could give a signal, leaving Matthews in the bottom. Before they could get the kibble properly to the mouthing which there is at this place, he let go and fell to the bottom. Matthews marvellously escaped almost quite uninjured. Previous shots (in rock) are supposed to have caused damage to the signal rope which escaped detection.	–	–	1	–	–	1

List of Fatal Coal Mine Accidents—*continued.*

No. of Accident.	Date.	Hour of the Person's Shift, i.e., No. of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost.					
										Explosions of Firedamp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous. Underground.	Above-ground.	Total.
41	1893. Nov. 8	7th	South Wales - (No. 2 Pit.)	Cwmtillery - (Monmouth.)	Lancaster's Steam Coal Collieries, Limited.	Hugh Roberts -	26	Labourer -	Fall of roof. Deceased was engaged assisting a repairer named Matthews of 17 years' experience in mines, ripping roof in a roadway and filling it into trams. Having ripped 6 or 7 yards in their shift, Matthews noticed a slip or joint in the roof, and as a pure matter of precaution, as he thought, he set a sprag under it. About an hour afterwards the stone fell, knocking the timber out, killing Roberts, as well as injuring Matthews.	–	1	–	–	–	1
42	" 9	9th	Celynen -	Abercarn - (Monmouth.)	The Newport Abercarn Black Vein Steam Coal Co., Limited.	Thomas Meredith -	47	Collier -	Fall of clod from the face. While filling a "basket" of coal on the floor, a small stone, only a few pounds weight, fell over from the face, and owing to his stooping position, knocked him upon the sharp edge of the "iron basket" which he was using, and caused him pain in the side for the rest of the shift, 5 or 6 hours, which he worked out. He afterwards remained an extra half turn, and only next day sent for the doctor who, upon examination, found that the damage was serious. Having a very weak constitution, the effects proved fatal on the 2nd December. According to the	–	1	–	–	–	1

List of Fatal Coal Mine Accidents—*continued.*

No. of Accident.	Date.	Hour of the Person's Shift, *i.e.*, No. of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Firedamp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous. Underground.	Above-ground.	Total.
	1893.								medical evidence death probably would not have resulted had he been a reasonably healthy man.						
43	Nov. 10	7th	South Wales -	Cwmtillery - (Monmouth.)	Lancaster's Steam Coal Collieries Limited.	Thomas Prosser -	68	Wagon repairer.	A Great Western locomotive was about to take a train of loaded trucks from the branch line sidings, and pushed up the wagons sufficiently to allow of the sprags being withdrawn. Deceased, who was thoughtlessly leaning with his arm round one of the the buffers, was caught between two of them, and died on February 12th 1894 from the injuries he received.	–	–	–	–	1	1
44	„ 10	12th	Glyn - -	Pontypool - (Monmouth.)	The Bryndu Coal and Coke Co., Limited.	David Yemen -	32	Shunter -	Slipped off the buffer of a railway truck on which he was riding on the Colliery Branch Railway, and received injuries from which he died December 18th.	–	–	–	–	1	1
45	„ 13	4th	Camerton -	Near Bath - (Somerset.)	Miss Jarrett - -	William Hawkins - Edward G. Tarrant	32 17	Repairer - Labourer -	Explosion of dust. They having fired a shot in the roof with $\frac{1}{2}$ lb. to $\frac{3}{4}$ lb. of powder, an ignition of dust resulted and caused an explosion, which wrecked 1,000 yards of roadway (*see* Special Report, dated 4th January 1894).	2	–	–	–	–	2

List of Fatal Coal Mine Accidents, &c.—*continued.*

No. of Accident.	Date.	Hour of the Person's Shift, i.e., No. of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Firedamp.	Lives lost. Falls of Roof and Sides.	Lives lost. In Shafts.	Lives lost. Miscellaneous. Underground.	Lives lost. Above ground.	Lives lost. Total.
46	1893. Nov. 21	8th	New Tredegar	New Tredegar - (Monmouth.)	The Powell Duffryn Steam Coal Co., Limited.	Frederick Boundy-	21	Collier -	Fall of coal from the face. He was pulling down some coal from the face, when it came off further than he anticipated, and falling upon him caused injuries from which he died 10 days later. On making inspection in this part of the mine, I found gross laxity in respect of setting sprags. The manager promised that he would deal with the responsible officials in this case, as well as the men, with the result that the overman and eight colliers signed apologies, which were printed and posted up at the works as a warning for the future. If the officials, overmen, and examiners take no more notice of what goes on in their districts than they appear to have done with regard to spragging in this one, and to timbering in that in which the accident occurred on the 3rd June, it is simply waste of money to have them there at all, pretending to see that the provisions of the Act are complied with, and grave responsibility will rest upon the owners, agent, and manager.	–	1	–	–	–	1

List of Fatal Coal Mine Accidents, &c.—*continued.*

No. of Accident.	Date.	Hour of the Person's Shift, i.e., No. of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Firedamp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous. Underground.	Above-ground.	Total.
47	1893. Dec. 4	4th	Celynen	Abercarn (Monmouth.)	The Newport Abercarn Black Vein Steam Coal Co., Limited.	Samuel Hughes	19	Haulier	Fall of roof. When taking a tram of rubbish into a stall for stowing up the Gob, he passed the turn out a short distance and was backing the horse. It appears to have disturbed some of the timbers, resulting in a fall which buried and smothered him. The fireman was close beside him when it occurred, and himself only narrowly escaped.	–	1	–	–	–	1
48	„ 8	10th	Llanbradach	Pwllypant (Glamorgan.)	The Cardiff Steam Collieries Co., Limited.	David Thomas	24	Banksman	While putting the box or cradle into the shaft for the fitters, who were going to do some work at the pumps or steam pipes, the side boards around which he had put the chains for lifting it gave way, and he fell down the shaft with it. The arrangements for this work were unsatisfactory.	–	–	1	–	–	1
49	„ 16	7th	Coalpit Heath	Frampton Cottrel (Gloucestershire.)	Coal Pit Heath Co.	Thomas Horseman	67	Collier	Fall of roof from slips in his working place while in the act of putting on his clothes at the end of the shift.	–	1	–	–	–	1
50	„ 19	1st	Blaina (Griffin Pit.)	Blaina (Monmouth.)	J. Lancaster & Co., Limited.	Evan Powell	64	Shunter	Blocked between the buffers of railway trucks, near the screens, while lowering them for filling.	–	–	–	–	1	1

List of Fatal Coal Mine Accidents, &c.—*continued.*

No. of Accidents.	Date.	Hour of the Person's Shift, *i.e.*, No. of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Firedamp.	Lives lost. Falls of Roof and Sides.	Lives lost. In Shafts.	Lives lost. Miscellaneous. Underground.	Lives lost. Above-ground.	Lives lost. Total.
51	1893. Dec. 20	1st	Blaina (Griffin No. 3 Pit.)	Blaina (Monmouth.)	J. Lancaster & Co., Limited.	Charles D. Selway	16	Collier	He was riding on the foot board of a colliers' train going to work, and on arrival at the colliery got crushed against the platform.	–	–	–	–	1	1
52	" 20	7th	Tillery (Penybout Pit.)	Abertillery (Monmouth.)	Powell's Tillery Steam Coal Collieries, Limited.	David John Ashton	15	Collier's boy	Fall of roof. A bell-shaped stone fell from the roof close to the face, striking him on the back of the head. The place seemed to have been fairly well timbered.	–	1	–	–	–	1
53	" 21	6th	Rhymney	Rhymney (Monmouth.)	The Rhymney Iron Co., Limited.	John Hines	17	Collier	Fall of roof in a face of Nottingham long wall. He was at the time, by direction of the timberman, taking a piece of coal off the face in order to allow of a prop being set between the face and the tram road.	–	1	–	–	–	1
									Total lives lost	2	29	7	10	10	58
									Total of fatal accidents	1	27	5	10	10	53

Fatalities not comprised under the Act.

The following accidents and deaths which occurred more or less in or about the mines of the district, but which do not appear to be the result of accidents comprised under either of the Mines Regulations Acts, have been reported to me. I consequently append the following list in accordance with my practice heretofore :—

1. Richard Gillson, about 58 years of age, a collier all his life, was on 22nd February seized with a fit of coughing on reaching his working place, about 80 yards from the pit bottom, in the Dean Lane Colliery, and burst a blood vessel, which resulted in death before he could be removed to the surface.

2. John Barry, 48 years of age, a mason, who was out of work, appears to have entered a coke oven at the Whitworth Colliery, Tredegar, on Monday evening, 13th March, with a view of sleeping there, and was found dead on the afternoon of the following day. The coroner's jury returned a veadict of "Death from natural causes."

3. John Clark, 45 years of age, a surface labourer, on the 19th May dropped down and died from heart disease on his way to work, just before reaching the Llanbradach Colliery.

4. Frederick W. Taylor, aged 12 years, school boy, on the 22nd July, was crushed at the Sirhowy Waterwheel Pump, belonging to the Tredegar Iron and Coal Company, by the crank, upon which he appears to have been riding. He climbed over the fencing in order to do this.

5. George Kingsbury, aged 53, collier at the Varteg Colliery, died on the 6th August, death being alleged to have been caused by shock to his system on the 13th June, when Ernest Davies was killed. The medical evidence at the inquest proved that death was in no way connected with any such accident, as shown by the post mortem examination.

6. Ernest Thomas, a boy 9 years of age, was killed on the 24th August, by a quantity of earth falling in upon him while he was rooting for coal in the outcrop of some of the seams belonging to the Glyn Colliery, near Pontypool. It appears that the inhabitants of the neighbourhood, unknown to the manager, frequently obtained coal in this way, especially during this time, when the colliers were on strike. At my request, the manager promised to take stringent measures to prevent this kind of thing, which has frequently resulted in fatalities here and elsewhere in the district.

Mr. Martin's Report.

REPORT on the INSPECTION of MINES in CORNWALL, DEVONSHIRE, DORSETSHIRE, GLOUCESTERSHIRE, HAMPSHIRE, ISLE OF WIGHT, HEREFORDSHIRE, SOMERSETSHIRE, and WILTSHIRE, under the Metalliferous Mines Regulation Acts, 1872 and 1875, with the Slate Mines (Gunpowder) Act, 1882, for the year ending 31st December 1893.—By JOSEPH S. MARTIN, Esq.

SIR, Durdham Park, Bristol, 10th March 1894.

Introductory.

I HAVE the honour, in accordance with Section 20 of the Metalliferous Mines Regulation Act, 1872, as Inspector of Metalliferous Mines in charge of the South-Western Mining District, to submit to you the following report with reference to the working of the Act, and such other matters in connexion therewith as appear to me to be of interest.

In the tables which I embody in my report for the purpose of comparison with the results of the present year, I have combined the figures of districts Nos. 12 and 14 of previous years, they being now included in this district.

Accidents and deaths.

The number of separate fatal accidents during the year shows a decrease of one, which, considering the reduced number of persons employed, leaves the proportion little altered, but I regret having to report that the number of lives lost by these fatal accidents shows an increase of 25, due to the disastrous inundation at Wheal Owles, near St. Just, on the 10th January, and the likewise disastrous run of ground at Dolcoath Mine on the 20th September. These accidents are dealt with in detail further on.

Decrease of persons.

I regret having to report a continued falling-off in the number of persons employed in and about the mines under this Act. The total decrease during the year amounts to 648 persons; of these, Cornwall contributes 620, Devonshire 11, Dorsetshire 7, and Gloucestershire 68; on the other hand, there were three more employed in Somersetshire, and 55 more in the stone mines of Wiltshire, leaving the deficiency as stated for the whole of the district.

Depression in mining.

The depression in mining, which I referred to in my last year's report, has not only continued, but has become very much intensified. The price of tin, the most important mineral wrought, has fallen to a point which has not been approached since 1879, and which is a very serious matter for Cornwall.

Unless an improvement in the tin trade soon makes itself apparent, I very much fear that several of the present mines which are struggling for existence will have to be stopped, a thing that can ill be afforded.

Managers.

A mine Manager, nowadays, should be thoroughly educated in the Scientific Branches of mining, as well as have had good practical experience in the actual working of them. The day has passed when the fact, that a man has been a good practical working miner and nothing more is sufficient qualification for a mine Manager, and equally the day has not arrived, nor is it likely to, where the pure scientist will make a successful Manager. Experience in various districts, and knowledge of what goes on in them, is essential for taking advantage of present day improvements. These qualifications of theory and practice, combined with good common sense and absence of an excess of prejudice against innovations, would, I believe, enable successful mining results to be brought about in several parts of Cornwall and Devon.

Insufficient capital.

The system of working mines in Cornwall, practically without capital, prevents their proper and expeditious development, and renders them highly sensitive to trade variations and depressions, with the result that they can only be looked upon as speculations, and not investments. Having in previous reports expressed my views as to the prejudicial effect which follows such conditions, I do not intend repeating myself now. In order that Cornish mining shall regain the confidence of the public, which might reasonably be expected from the opportunities which present themselves in the county, it seems to me that considerable changes will have to be effected in the financial conditions and customs, as well as in the system of conducting and managing the mines. I see no reason why some of the money which flows into foreign countries for the development of mines should not be kept at home with a reasonable prospect of good investment, if the work were gone about with combined energy and efficient practical and scientific skill, but neither the practical man nor the scientist alone will suit the present day.

In my opinion, the mines in Cornwall are not generally developed or explored with sufficient speed for advantageous mining, but of course exceptions exist. They are started with insufficient capital, and drag along with a few men, regardless of the fact that the dead expenses of management, pumping, and surface labour, swallow up a large proportion of the already insufficient capital available. The hopes of striking tin are so dangled before the adventurers, that they eke out an existence for the mine over a lengthened period, whereas, if modern machinery was employed, and work gone about energetically, in many cases good mines could be opened out in a comparatively short time, and, at any rate, much more work would be done for the money expended. Development.

In the present day of rock drills and other available mechanical arrangements, so close at hand compared with foreign mines, it seems inconceivable to hear of large mines without a single "rock drill" or boring machine at work, and "ends" or levels, only advanced at the rate of 10 feet to 15 feet per month. In some of the largest mines the amount of work done in exploring with "rock drills," only perhaps 3 to 5 being employed in a mine, seems quite below what might reasonably be expected for energetic work. I have been surprised to find that 6 to 8 fathoms a month is considered good work in driving ends with rock drills in Cornwall, especially when one hears of 55 fathoms averaged over a period of five months in a gold mine in the south of Europe about three years ago. Of course, there may be a considerable difference in the hardness of the ground, but during the past two years I have spoken to several mine Managers in Cornwall, urging that it would be worth while to see whether such work, or anything approaching it, could be attained in these mines, I informed them at the same time, that the contractor who did that work guaranteed a minimum drivage, and received premiums upon additional distances driven. No interest appeared to be taken in the matter, the usual reply in words or effect being that "we in Cornwall, can do as much as anyone else in our ground."

It is unanimously admitted that the importance of opening up the ground quickly cannot be exaggerated, yet no attempt has been made to ascertain the circumstances or conditions under which the work referred to was carried out. It might have been expected that the Managers hearing of such comparatively enormous work would have brought the subject before their committees of management, with a view of having a trial, or at least an inquiry, made. Self satisfaction may be very good in some cases (and I do not even mean to say that the parties who performed the work referred to would do so much under the existing circumstances in the Cornish mines), but when it stands in the way of making inquiry as to what is being done in other districts and countries it is highly prejudicial and hurtful to the respective interests, whether mining or any other class of industry.

I would suggest to mine Committees the desirableness of sending their Managers and Agents for occasional visits to other mining districts, at home and abroad, to see what is going on, and require them to report fully upon what they have seen, and I would further point out that it need not be exactly the same class of mines that they should always visit in order to be advantageous. To see winding arrangements and the quick manipulation of large quantities of mineral they could with advantage visit collieries, and I have offered several to assist them in gaining admission to such mines, in my own or adjoining districts, if they desired to visit them. While fully admitting and admiring the good results obtained from pumping engines in Cornwall, I consider winding arrangements generally require to be improved, and that in some cases they are inadequate to allow of the mines been developed on an extensive scale.

I have no doubt that criticism of this kind will displease some parties, but I wish it to be clearly understood that I do so in a friendly spirit and for the good of the district. I in no way make individual or personal reference, and if any one thinks so, it must be in consequence of the estimate he had himself formed of whoever it is considered to apply to; my object is merely to draw attention to what appears to me to be a false principle, financially and otherwise, which is in many instances detrimental to the mines and the mining community.

Blame does not in all cases belong to the Adventurers any more than it does to the Managers and Agents. In some cases it lies with the one, while in other cases it lies with the other, and not unfrequently more or less with both in consequence of the system. Managers, however competent or willing they may be, can do very little to their own credit or the owner's advantage unless supported with capital, which should be energetically, and at the same time judiciously, expended. They should set their faces against working for temporary effects, and while it is desirable that they should hold an interest in their mines as an investment, they should not speculate in the shares directly or indirectly.

I have for some time past thought that the application of electricity for driving "rock drills" would be advantageous and convenient. I have heard within the last few days that the application of electricity to work these machines has been effected for some time past, and that it is in actual work, I believe in America. I had forgotten a paper which was read on the application of electricity to this class of work in February 1891, before the Institute of

Civil Engineers, by Messrs. L. C. and C. Atkinson, since which time I have no doubt there have been improvements in regard to the practical application of the power.

Resuscitation of Cornish mining.

For some time past there has been a correspondence going on in the "Mining Journal" as to "whether Cornish mining can be resuscitated," and since giving expression to the foregoing opinions I have seen a letter published in the Journal of 27th January, which I think may be quoted, especially as it is from a Cornish man, who it appears has had home and foreign experience. The letter is open to and has been much criticised in the "Mining Journal" and "West Briton." I hope the result of the correspondence, which has extended over months, may be beneficial.

To the Editor of "The Mining Journal":—

DEAR SIR,

As your valuable journal is found all over the mining world, it reaches us at our Asbestos Club, and I can assure you we find it very interesting. The managers here come from Cornwall, Wales, and Germany; but anything from Cornwall is of greatest importance to us, for it seems as if it were a voice from home. In your issue of November 18th there was a very interesting article entitled "Cornish Mining—Can it be Revived. An Australian Remedy." The main point elaborated upon was how to improve mining in Cornwall. To my mind this could be done in many ways, for the tin and copper is not all dug out of her mines yet, nor do I think all her mines have yet been discovered. Mining might yet revive, and investors find profitable investments if the work in Cornwall were pushed ahead as it is here and in the States.

It is a well-known fact that in Cornwall the miners do not receive more than the average rate of wages, which in many cases is not enough for the support of a family. This is an outrage upon the miner and an injury to Cornwall, and to those whose money is invested there, seeing that the skilled miner does not receive any more money than those of ordinary ability and of less practice. The custom is to set a gang so many fathoms to work. This enables them to see how much will be needed to give them the wages allowed by their particular mine. The men know the old dodge, and work accordingly; they could often get 50*l.* per month more than their bargain, but they know if they did so their price would be cut down in the next month; so they sit down when they would rather be working. Where the takings are reckoned by the month, the men, if they got what is allowed, would stay away from the mine so as to keep to the old price, and in many cases the old price is a good one, though they could get more if it were allowed. Who is responsible for not allowing it I do not know, but such is said to be the case. There is another class of miners who never get the full amount, because there is as much scope in the mine for "spending ground" as in any other class of labour, where work is done by contract. Hence the skilled miner in Cornwall must not get all he could get, but only what others not skilled are allowed to get.

The fact is that all men could do better on the captain's prices if they were allowed, for it is the custom with the miners to sit down when they get into the mine and tell stories, sing, and waste a good bit of time every day in order to earn the average wages alone. If every manager in Cornwall were to give each gang a contract for the month, and tell them to push the work ahead and get all they could, the result would be that the stamps would have to run much faster, and at the end of the month it would be found fully one-third more ground would be "spent," and, of course, one-third more of tin and copper raised. This would encourage the men to work as hard as possible. When a shaft is to be sunk the plan should be to set the contract for the number of feet to be sunk; do the same in sinking from level to level, and pick out the best men for these contracts. In this way the miner would get more wages on the same price per fm., the output of tin and copper would be increased in proportion to the ground spent, and work that now takes six months would be done in very nearly half that time, and with no more cost.

Thus it will be a big saving to companies as to the water charges and other expenses, which must continue until the shaft is going down, whether it takes three months or six. This plan of work will put every man on his own merit, and I know he will do his best to get as much money as he can. The sitting on the pick handle, telling stories, and wasting time, will all be done away with, and the men themselves will get good wages, companies will have better returns, and the mining industry in Cornwall will be revived to an extent which the oldest man now living does not remember, and an increase of more than one-third—such as I am sure would result from an adoption in Cornwall of our American system—would be from 20 tons of tin per month, which, at the low figure of 50*l.* to 30*l.* a ton would be equivalent to an additional 500*l.* After there had been deducted from this the 120*l.* increase on labour, a balance of profit would be left to the company of 380*l.* Whether the mine were large or small, or rich or poor, it would be improved under this arrangement.

There is another thing the captains must see to, and that is that their men should never be stopped from their work to wheel away the stuff, as there will be so much tin or copper lost at every stoppage. The miners should remain at their work, and a man should be appointed to look after the stuff, so as to keep it out of the way of the miner. Tramways should be used instead of barrows. In this way young men who wish to go underground will have a chance to learn something, while all the miners will be kept at their picks. At present there are many days lost to the miner by his having to wheel his own stuff when he should be digging the ore. The captains should also see that the miner has his tools sent down in the morning and sent up again when work is done, which will save him the bother of lugging about the drills on his back, and carrying the picks in his hand, which is enough to cripple him. If this change be made some miners will get more than they do in this country, and will not wish to leave home.

Mines that are not paying will then pay, and those that are paying dividends will pay larger ones. Capital will be invested in Cornwall instead of in other countries where it is now sent. Let those in charge of the mines arouse themselves. They are now rather behind the age, though no man knows better what to do than our good old captains, who are, however, crippled by the present system. At present they are not paid sufficient to make them value their places. They should be given more, and should know that they must see for themselves that the work is pushed on.

The tribute system should be looked after more closely, and the output improved. When men have a good bunch of ore they do well. When the ground is poor they get downhearted and do not work as hard as they should, in the hope of borrowing something until they are able to pay it back. This is a good plan if the tributer is a good man. In that case, if his pitch is poor, he should be bound to stope so much ground before he is entitled to "cist," as they call it. Then if the ore is in it he would get wages; if not, he has done honest labour and should be entitled to the amount the company allow to tributers until he could pay it back.

The captain should do all he could to increase the value of his mine, as we do here in America; and I am sure from experience that the prices for spending ground in Cornwall are better than ours. I am from Crowan parish, Cornwall, and was brought up in the mines. I have been captain and manager in the States and here for over 23 years, and have found the only way to get on is to set contracts for the month, and then push the men on to get as large an amount of ore as possible, in order that they may get big pay. If this were done in Cornwall, mining would flourish, and men would be encouraged to do their best, and all would be benefitted by the change.

I have the honour to remain,

Yours truly,

Black Lake, Megantic County, Canada, MATTHEW PENHALE.
December 1893.

Condition of Drys. During the year I have had, in more than one instance, to draw attention to the accommodation provided to meet the 16th General Rule, which requires that "where more than 12 "persons are ordinarily employed in the mine below ground, sufficient accommodation shall "be provided above ground near the principal entrance of the mine, and not in the engine house "or boiler house, for enabling the persons employed in the mine to conveniently dry and "change their dresses." These "Drys," as they are locally termed, instead of being cramped, dismal, and dirty, should be cleaned out daily, thoroughly whitewased every three months, in order to keep them fit for persons to frequent and put their clothes in. I hope the managers, whether of large or small mines, will give this matter their attention.

Accident at Wheal Frances. An accident (which resulted fatally) occurred at South Wheal Frances United on the night core of the 12th April, by which one of the trammers had his foot fastened at the bottom of a "pass" in consequence of some of the timber work giving way and allowing the ore to fall into the level. He was unable to release himself, and those who came to his assistance likewise failed to do so, and were obliged to resort to timbering back the loose ore in order to prevent its sliding forward and covering him up. Information was sent to the surface to the Agent in charge of the core. He, instead of going down to superintend the rescue operations and ascertain the circumstances, sent a timberman, and himself remained on the surface, "in order to give out any stores which might be wanted." The doctor was sent for in order to be in attendance when the man was brought to the surface. He, it appears, offered to go down into the mine to attend the man, but was dissuaded

by the Agent, who did not even send to inform the Manager of the occurrence. He first became aware of it on arriving at the mine in the morning in the ordinary course, 11 hours after it happened. The Manager appears very properly to have gone to the place without delay, and superintended the operations which resulted in the man's release, after being pinned fast by the foot and leg for 22 hours. He was attended to by the doctor on reaching the surface, and conveyed to the Redruth Hospital where he succumbed to shock the following day.

That the Agent in charge of the day or the night core should spend his time on the surface instead of in the mine is a very different system of supervision to that which prevails in districts where energetic work is the order of the day, as well as where a sense of responsibility exists on the part of officials. This incidence strongly bears out my remarks in previous reports with reference to the necessity for improved and more energetic supervision in this class of mining. I noticed by a correspondence in the local newspapers after this inquest that some of the public thought the doctor should have gone down to his patient, and in that opinion I fully agree, as I consider it was all important that the unfortunate man should have had nourishment and stimulants administered under medical direction in order to sustain him, *but the doctor having offered to go to him could do no more*, as without the agent's sanction and co-operation he could not and dare not enter the mine. It seems to have previously been an unheard of thing in Cornwall for a doctor to descend into a mine to the assistance of an imprisoned or injured person, but in colliery districts it is not at all uncommon.

Absence of Accident with Explosives.

No notice of any injury from the use of explosives has reached me during the year, showing that there is a continuance of the increased care in the handling and use of these dangerous substances, to which I made reference in last year's report. This, I believe, is the first year of complete immunity from this source of accident.

Result of the Commissioners' Inquiries under the Boiler Explosions Acts.

It is also gratifying to be able to record a completely blank column in regard to accidents connected with the working of boilers, none, either fatal or non-fatal, having been reported to me. Since the heavy fines imposed upon the Wheal Grenville and Cook's Kitchen Mine adventures by the Commissioners sitting under the Boiler Explosion Acts, 1890 and 1891, there has been quite a revolution among Cornish Mine Engineers in regard to the management of boilers. This department has been thoroughly overhauled at considerable outlay, and as a result I hope that we have now arrived at a time when explosions will be as noticeable by their absence as in past years they have been by their occurrence.

Surveying and Planning.

I have for years past annually drawn attention to the unsatisfactory manner in which the plans of mines have been kept. I am not prepared to say that there is not improvement, there apparently is, but it is very slight, and these remarks are perhaps as much or more applicable to the coal mines in my district as to those under this Act. It is unfortunate that all mines have not been required to keep plans, but under this Act they are not required where less than 12 persons are employed below ground, with the result that numerous unrecorded dangers are created for miners of future generations.

I should like to see introduced into this country the German principle of having surveyors certificated or licensed, the certificate to depend upon the passing of such a strict and high class examination, theoretical as well as practical, as would ensure the candidate's competency to undertake extensive surface and underground surveys and likewise to plot and make neat and efficient plans. It should be a qualification sufficient to ensure as great accuracy as the Ordnance Surveys. Thorough responsibility should be placed upon the heads of firms undertaking to make or keep up plans, and they should be obliged to be certificated surveyors themselves. There are many Mining Engineers of large practice who undertake to keep up plans, and who do so entirely by assistants of varying qualifications, down to pupils. They probably never see these plans unless some especial question happens to arise, possibly a trespass through their own or their neighbour's plans being inaccurate. There are also a number of persons who style themselves Mining Engineers (which any person can do), and with this high-sounding title attract work from small owners, who, being little more than working men, do not appreciate the necessity of accurate and well-drawn plans, &c. I

have heard of a firm who style themselves Mining Engineers and Surveyors, where for years the junior member was unable to get a Manager's Certificate, having failed in his surveying, elementary as it is for such examinations. Yet, I have no doubt that a large part of the surveying of the firm has been done by him.

I do hope future legislation will deal with this important subject generally, as there is considerable extravagance and waste in the mineral wealth of private individuals, as well as of the nation, in addition to danger arising to the persons employed in mines from the way in which mine plans have been kept up.

The Fencing of Shafts.

The fencing of shafts continues to be a source of trouble and work, both clerical and otherwise.

I have written numerous letters calling the attention of the Owners or "Persons Interested in the Minerals" to the insecure condition of shafts, and I have pleasure in saying that usually prompt attention has been given to them, but reference to the list of prosecutions will show that I have had in two cases to institute magisterial proceedings.

In these cases my letters were entirely ignored, and having waited several months, I made inspection and found that nothing had been done, whereupon I forthwith reported them to you.

It should be clearly understood that the responsibility for the secure fencing of shafts rests with the Owners or "Persons Interested in the Minerals," who naturally expect their Agents to look after these matters, while they, the agents, are in no way responsible for them. I hope in the next Act that Agents will be made responsible as well as the owners, &c.

By your directions the following notice appeared three times in July 1892 in each of the following newspapers:—"The Western Morning News," "The Western Daily Mercury," "The West Briton Advertiser," "The Cornishman," and "The Mining Journal":—

To Mineral Owners, Landowners, Mineral Agents, and Others.

Whereas many of the fences of the disused mine shafts in the counties of Cornwall and Devon have latterly become much out of repair and a source of danger to the public—

Notice is hereby given that immediate steps must be taken by those concerned to have such defective fences made secure, in accordance with Section 13 of the Metalliferous Mines Regulation Act, 1872.

On and after the 1st March 1891, no fence will be considered "secure" that is not 5 feet in height.

Wooden coverings will not be deemed a sufficient protection.

Where iron railings are adopted they should be upright and pointed; they will then make a desirable fence.

Where "stone hedges" are employed it is strongly recommended that the top set at least be laid in lime or cement, to prevent the stones being detached and thrown into the shaft.

By order,
(Signed) Joseph S. Martin,
H.M. Inspector of Mines.

Myself, I would advise the filling up of least two-thirds of the abandoned shafts in Cornwall, in order that the responsibility which attaches to the "Persons Interested in the Minerals" might be got rid of, as well as the danger to the public.

Prosecutions.

During the year I instituted the following proceedings for contraventions of the Act.

On the 5th April, at the West Penwith Petty Sessions (Penzance), before The Reverend John Tonkin, J.P., and C. C. Ross, Esqr., J.P., the Purser and Manager of Wheal Owles was charged with having contravened the 19th section of the Act by not keeping an accurate plan of the underground workings of the mine.

The justices' decision, fining him 15*l.* and costs, is given at full length on page 58.

On the 10th of May, at the Braunton Petty Sessions (Barnstaple), Mr. Thomas Lerwell was charged that, being interested in the minerals, he contravened the 13th section of the Act by failing to have securely fenced the tops of two disused and abandoned mine shafts, situated in or adjoining the Pippacot Wood, in the parish of Braunton, such shafts being within 50 yards of a highway.

The defendant, in his defence, showed that under the Married Women's Property Act the property belonged to his wife, and that consequently he was not the Owner or "Person Interested in the Minerals."

The case was consequently dismissed.

I at once laid an information against Mrs. Lerwell, in order to show that although Mr. Lerwell escaped he only threw the onus on to his wife, and that it was quite in my power still to vindicate the Act. The objects desired having been attained, I subsequently, having received your permission, withdrew these proceedings.

On the 11th May, at South Molton, before Dr. N. C. Hatherley, J.P., and D. J. C. Bushe, Esq., J.P., the Molland Mining Company was charged with not keeping an accurate plan of the underground workings of the Brimley Mine.

A fine of 5*l.*, including costs, was imposed.

On the 23rd November, at South Molton, before Messrs. G. Cutcliffe, J.P., and D. J. C. Bushe, J.P., Lord Poltimore was charged that, being interested in the minerals of the Old Bamfylde Copper Mine, he contravened the 13th section of the Act by not having and maintaining the tops of the disused and abandoned mine shafts securely fenced for the prevention of accidents.

A fine of 5*l.* and 4*l.* 15*s.* costs was imposed.

There were no cases reported to me in which proceedings were taken against workmen by the owners or executives for contraventions of the Act during the year.

As in former years I present in this report the persons employed, the mineral wrought, and the accidents, under separate sections or headings.

I have in the several tables combined the figures of former years in the districts 12 and 14 in order to allow of comparison with the district as it stands at present, comprising, as it does, those two districts.

Part I.—Annual Returns of Persons Employed.

The following table summarises according to counties the returns of the number of persons employed in and about the mines of the district, as now constituted, during the year 1893, and also enables a comparison to be made with the figures similarly given in last year's report.

It will be seen that there is a decrease of 648 persons, of which 306 are underground and 342 above ground.

Situation of Mines.	Underground. Male Persons.				Above Ground. Including Dressers within the boundary of the Mine.								Total number of Persons employed (above ground and underground).
	12 to 13.	13 to 16.	Above 16.	Total.	10 to 13. Males.	10 to 13. Females.	13 to 18. Males.	13 to 18. Females.	Above 18. Females.	Above 18. Males.	Total.	
Cornwall	4	175	4,856	5,035	26	1	764	279	660	2,890	4,620	9,655
Devonshire	1	2	430	433	1	—	73	14	12	374	474	907
Dorsetshire	—	—	166	166	—	—	26	2	—	76	104	270
Gloucestershire	—	70	223	293	1	—	7	—	—	81	89	382
Somersetshire	—	2	37	39	—	—	12	—	—	27	39	78
Wiltshire	—	29	634	663	4	—	18	—	—	115	137	800
Totals	5	278	6,346	6,629	32	1	900	295	672	3,563	5,463	12,092
Totals in 1892	11	307	6,617	6,935	27	4	1,080	304	813	3,577	5,805	12,740

PART II.—MINERAL WROUGHT.

From the table given on page 9, of the summaries of the statistical portion of the Inspector's reports, the total quantities of mineral returned as having been wrought in the mines of this district during the past year, were 292,991 tons, against 296,215 tons in the preceding year, showing a decrease of 3,224 tons.

This comparison, however, gives no reliable indication of the condition of the mining interests, inasmuch as dressed minerals such as tin ore, having a value of 40*l.* to 50*l.* per ton, are equally included with undressed minerals, such as clays, stone, &c., the values of which do not exceed 10*s.* to 15*s.* per ton.

A detailed comparison of the quantities of the respective minerals wrought during the years 1890, 1891, 1892, and 1893 may give a better idea on the subject, viz.:—

—	1890.	1891.	1892.	1893.
Antimony	—	10	6	—
Arsenic (powder)	4,154	6,016	5,114	5,969
Arsenic (Pyrites)	5,144	5,095	4,497	2,912
Barytes	2,000	2,600	2,077	1,200
Clays	78,002	66,028	75,021	72,649
Copper ore	11,032	8,287	5,631	5,144
Copper precipitate	—	9	—	—
Fluor spar	—	22	—	—
Iron ore	70,402	68,824	67,277	60,242
Lead ore	—	80	15	—
Manganese ore	306	130	840	325
Ochre	372	346	528	1,373
Slates, and slabs	10,047	5,407	11,176	270
Stone	109,525	102,513	108,410	128,038
Tin { dressed	12,969 (dressed and undressed)	13,025 } 17,387	12,958 } 15,449	12,258 } 14,801
Tin { undressed		4,362	2,491	2,543
Uranium	21½	31	37	25
Wolfram	104	138	125	22
Zinc (Blende)	—	—	12	21

PART III.—ACCIDENTS.

The 13 fatal accidents, with 39 deaths, recorded in the appended schedule—11 in Cornwall (in 8 mines), 1 in Devonshire, and 1 in Wiltshire—compare favourably with the previous year as regards the number of accidents, being for the whole district at the rate of 930 persons employed per fatal accident, compared with 911 persons in 1892, but they compare very unfavourably as regards the number of lives lost, being for the whole district only 310 persons employed per death, as compared with 911 persons in 1892. These figures are due to the Wheal Owles and Dolcoath accidents.

The fatal accidents recorded in the schedule appended are classified under the following heads:—

Cause of Accident.	Accidents.	Deaths.
UNDERGROUND—		
Falls of ground—there were three in Cornwall and one in Wiltshire	4	11
In Shafts: 2 Falling part way down; 1 Crushed by skip; 2 Things falling in shaft; 1 Boy slipped on ladder a few feet	6	6
Miscellaneous: 1 Irruption of water by which 20 lives were lost; 1 Breakage of part of a "pass" or shoot	2	21
ABOVE GROUND—		
Miscellaneous: Falling from a gangway	1	1
Total	13	39

Falls of Ground.

The accidents under this heading rarely require lengthened reference to be made to them beyond what appears in the schedule giving the list of accidents, but on the 20th September, about 1 o'clock in the afternoon, the most disastrous fall or run of ground of which (so far as the loss of life is concerned), I have had experience under either this Act, or the Coal Mines Regulation Acts, occurred in the 412 fathom level of Dolcoath Mine, east of the "New East Shaft."

Eight persons, who, with as many more, were engaged strengthening a "stull" on the back of the level lost their lives. The others, although uninjured, very narrowly escaped the fate of their comrades, especially one named Davis, who was entombed 36 to 40 hours before he could be reached.

The 412 fathom level is the deepest which has been opened upon in this mine, although the shaft is down far enough for the 425 fathom levels. The lode at the site of the accident is 30 feet wide, and, in consequence of being very rich for tin ore, the whole width is "stoped" or worked away and sent to the surface, leaving a large cavity above the level 35 to 40 yards long, 10 yards wide, and at the highest point within 2 or 3 yards of the 400 fathom level.

The "stull" consisted of 21 baulks of pitch pine 18 to 20 inches square and 30 feet long, set, as shown in the accompanying drawings, which were prepared for me by Mr. E. E. V. Stokes, at distances of about 3 feet apart. Over these "stull pieces" there were sheeting planks or slabs upon which 2 or 3 fathoms of "deads" or rubbish was piled. A certain proportion of the "stull pieces" were strengthened with "studdles" and "legs," as shown in the drawings. The transverse section shows considerably more "deads" upon the stull than was the case previous to the accident, except *possibly* at some special point.

The underground Agent having noticed that some of the "stull pieces" were bending, gave the chief timberman, John Pollard, one of the deceased, instructions to strengthen the "stull." He accordingly, the day before the accident, got the necessary timber for "stull pieces," "studdles," and "legs" sent down, and on the day of the accident took three or four experienced timbermen with him to the place, as well as about a dozen labourers to assist in putting up these heavy baulks, &c. When the accident occurred they were engaged with one of these long "stull pieces," which they had hanging on the blocks at the time, trying to set it between some of those which were bent.

It was at first thought that, in preparing the foot bed for this piece, one of the others had been undermined, and loosened, but the witnesses at the inquest gave evidence clearly showing that such was not the case. They stated that they heard a noise above the "stull" as if a heavy fall or run of ground had occurred, and again a second one, followed immediately by the collapse. This view of the cause of the accident is corroborated by the fact that a large portion of the lode or ground under the roadway of the 400 fathom level fell away at the same time, causing the collapse of the roadway at that level, as shown on the accompanying longitudinal section.

Information of the accident was conveyed to the surface as soon as possible, when search parties were organised and sent down. Two of the men, Osborne and Davies, were found to be alive, but Osborne appears to have died that evening. Davies was rescued as already stated, 36 to 40 hours later, and his escape may be truly termed "marvellous." "Cores" or shifts of men continued working day and night in search of the others, but the difficulties met with in dealing with these huge timbers and rubbish were such that the last body was not recovered until the 11th October, or 21 days after the accident.

Every exertion was made by the officials and workmen to the best of their powers for the rescue of the men, and subsequently for the recovery of their bodies.

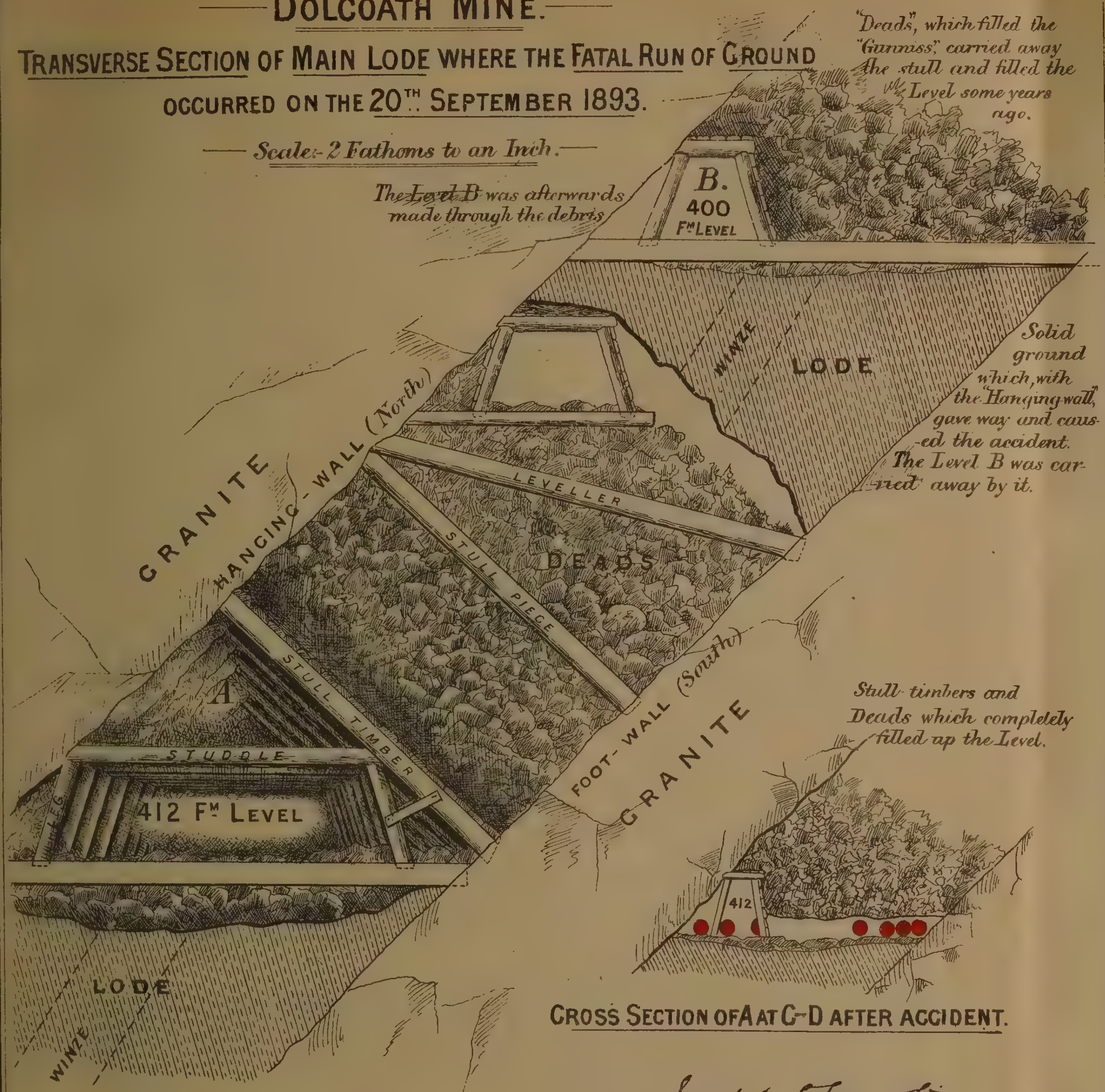
Similar runs of ground have, it appears, on various occasions occurred in this and other mines in the county, although fortunately they have not been attended with such disastrous consequences to life. This one, however, brings into prominence the question whether some means cannot be adopted for the prevention of such catastrophes, by completely filling up the "gunnisses" with "deads," brought, if necessary, from the surface, or in some other manner; but difficulties exist even in this mine; wealthy as it is I question if the winding arrangements are adequate for such purpose in addition to drawing the ore, lowering the men and materials.

It is I believe admitted on all sides that a thoroughly good perpendicular shaft 19 or 20 feet in diameter, fitted with modern winding and pumping arrangements, is desirable for the economical working of the mine, the increased safety of the men, as well as general convenience and comfort, but the owners or adventurers do not think they are the parties who should pay the 50,000*l*. or 60,000*l*. which it would cost, and consequently they go on from quarter to quarter dividing their profits.

DOLCOATH MINE.

TRANSVERSE SECTION OF MAIN LODE WHERE THE FATAL RUN OF GROUND OCCURRED ON THE 20TH. SEPTEMBER 1893.

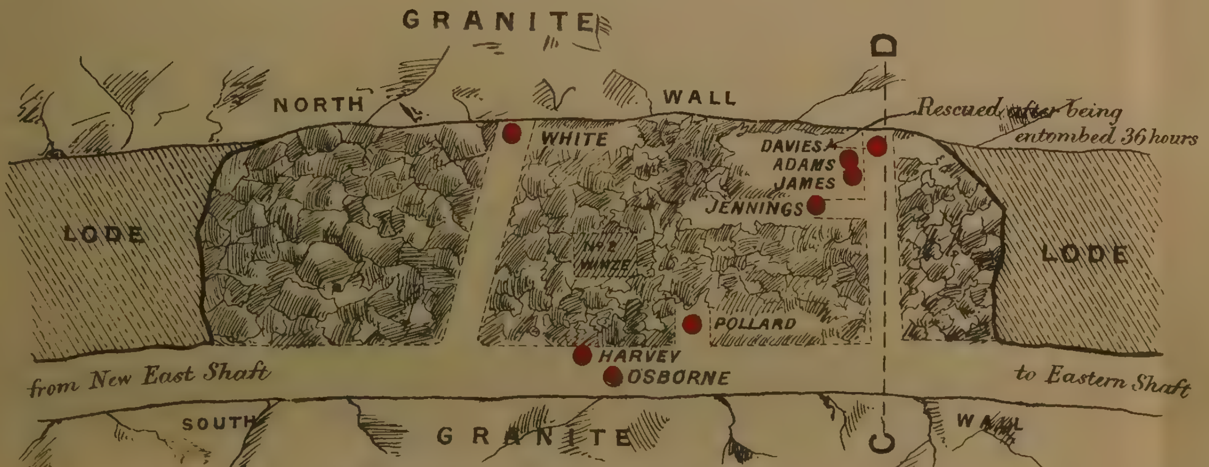
Scale:- 2 Fathoms to an Inch.



CROSS SECTION OF A AT C-D AFTER ACCIDENT.

Joseph S. Martin
H. M. Inspector of Mines

PLAN OF LEVEL A SHOWING WHERE STULL FELL IN AND THE POSITIONS OF THE BODIES WHEN FOUND.



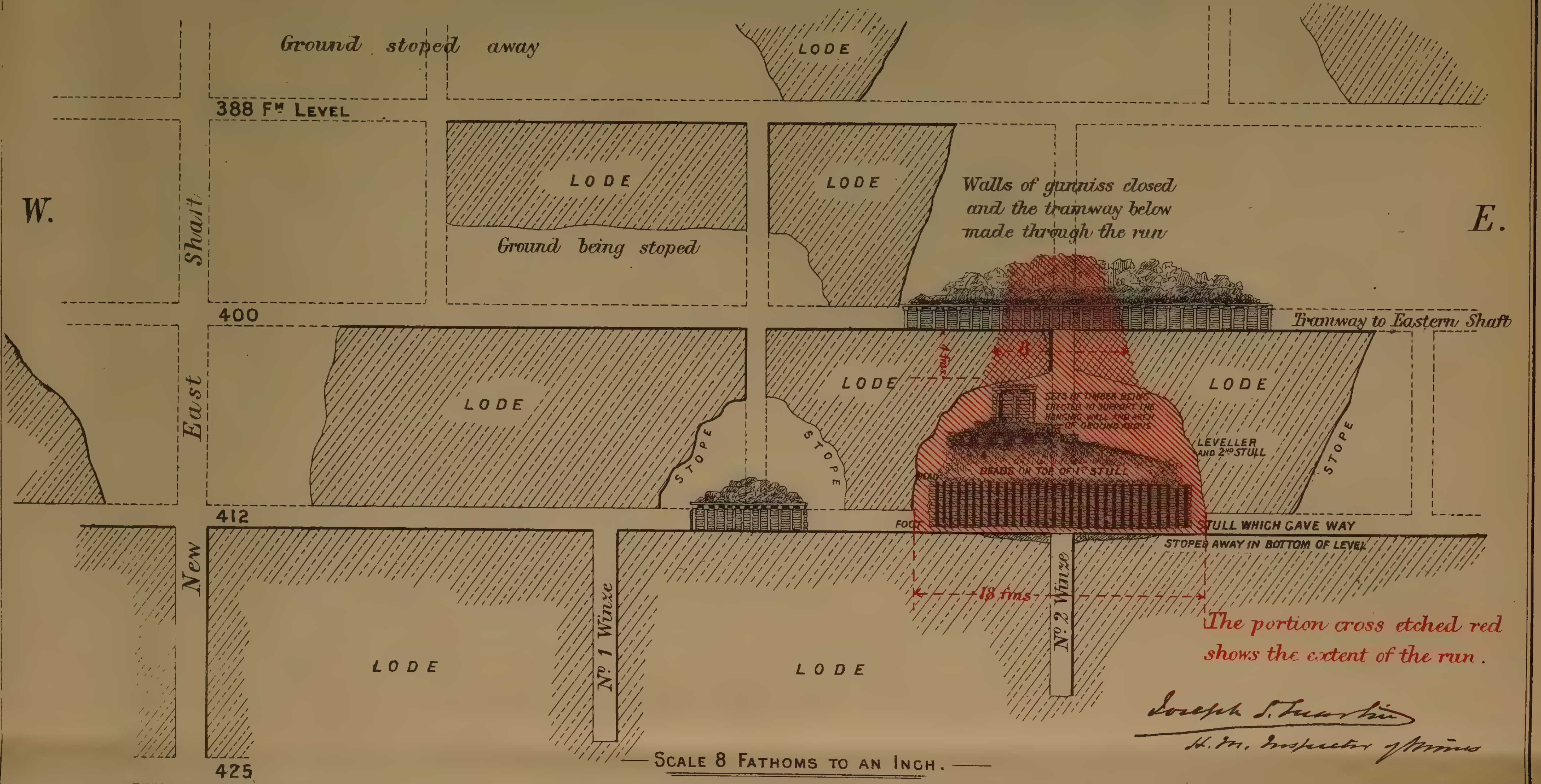
Scale:- 4 Fathoms to an Inch.

Judd & Co. Ltd., Lith. 63, Carter Lane, 5664 2 94.

DOLCOATH MINE.

(MAIN LODE)

LONGITUDINAL SECTION SHOWING THE GROUND STOPED AND TO BE STOPED
ALSO THE POSITION OF THE STULLS &c.



SCALE 8 FATHOMS TO AN INCH.

Judd & Co. Ltd. Lith. 63, Carter Lane. 5664·1·94

There are, I have been creditably informed, other mines, some even still working, where the shaft and winding arrangements are so inadequate that the ore, which could be brought to the shaft, cannot be wound to the surface in addition to lowering men and materials.

I refer to these matters here merely in connexion with the question of filling the "gunnisses" or other means far securing safety, and to show the difficulties which exist, and which will not be got over except by legislation.

The following is the evidence given at the inquest as it appeared in "The Western Morning News," Tuesday, 10th October 1893:—

THE DOLCOATH DISASTER.

INQUEST AND VERDICT.

The inquest on the seven miners killed by the fall of earth in Dolcoath Mine on the 20th instant was opened at Tyack's Hotel, Camborne, yesterday morning, by Mr. G. P. Grenfell, County Coroner. Mr. S. Trevillion was foreman of the jury.

The Coroner explained that he had only directed the inquest to be held on the body of John Henry Jennings, which was the first recovered. The circumstances by which all these poor men came to their death were pretty nearly the same, therefore it was unnecessary to encumber the papers and to trouble the jury to inquire into the death of five or six when one would suffice. It was a most lamentable case, and it would be their duty to see whether anyone was to blame, and if so who, and to see whether everything practicable was done to prevent accident.

Mr. J. S. Martin, H.M. Inspector of Mines, and Mr. E. E. V. Stokes, Assistant Inspector, represented the Home Office; Captain Josiah Thomas, Mr. F. W. Thomas, and Captain James Johns, represented Dolcoath Mine; and Superintendent Coombe was also present.

John Jennings, father of the deceased, identified the body.

Captain Josiah Thomas, the manager, put in a photograph, a ground plan and section of the part of the mine where the accident occurred. He also made the following written statement: I am the Manager and Purser of Dolcoath Mine, having been appointed Manager in 1868, and Purser in 1883. The mine has been worked continuously since 1799. The deepest level is the 425 under adit, or 453 from surface. The lode becomes larger as depth is attained, and in the deeper workings east of the engine shaft it is 20 or 30 feet wide, with an underlie of 48 degrees south, or a little over 4 feet in the fathom. The country rock on both sides is granite. In stoping away the lode we sometimes leave arches standing, and where arches are not left we put in large timbers across the workings at about right angles to the underlie of the rock. The timber used for this purpose is principally pitch pine 18 to 20 inches in diameter, propped when considered necessary, by pitch pine or large pieces of Norway timber 12 to 16 inches in diameter. Captain James Johns, our chief Underground Agent, has the principal direction of the timber work, together with the other three underground agents. Pollard, the Chief Timberman, was directing the men who were working with him at a point in the 412 fathom level, 40 fathoms east of New Shaft, when the accident occurred. No expense has been spared in securing the ground throughout the mine. I was in the very place where the accident occurred the day previous, and considered the stull to be perfectly safe. I was in the immediate neighbourhood of it for about an hour.

By Mr. Martin: One of the agents was underground every day. He was the General Manager of the mine, and Captain Johns was the chief Underground Agent.

Mr. Martin: But under the Mines Act you take the responsibility in the first instance as Manager?—Witness: I suppose so.

It rests with you to see that there are proper and sufficient agents and persons employed to carry out your directions?—Probably so.

Under your direction Captain Johns takes charge principally of the underground working?—Yes, he is the chief Underground Agent.

Witness, continuing, said he first heard of the accident about three o'clock in the afternoon, and going underground found the place in the 412 collapsed up to 5 or 6 feet of the eastern end. It was about 14 fathoms from one end to the other. After the accident he was informed that there were certain persons missing who had been working there. Men were put immediately to work at the both ends to clear the stuff and to put in timber. They got to work instantly, in fact they took several men down with them to begin to work at once. There were many difficulties to contend with in clearing the huge rock and the large pieces of timber, which were all mixed up together. The rocks were blasted very cautiously, and the

timbers had to be cut out bit by bit, so that it had been an extremely slow process. In the first place they tried to ascertain whether anyone was alive; they called as loudly as possible, and made the loudest sounds they could, but there was no response. He presumed that Davies must have been asleep just at that time, because he said he had heard the men working afterwards. Davies was rescued after 37 hours. The 400-fathom level had collapsed for about the same length as in the 412. The strength of the stull was equal to more than three times the amount of stuff that was on it.

Mr. Martin: Previously have you had runs of ground in the mine?—Witness: Yes, we have had runs, but nothing serious.

Have they carried away stulls?—Yes, stulls have been carried away in disused workings. Stulls above the 400 are broken down because we have no use for them as long as the tramways are open.

Have you formed any opinion as to how the accident occurred?—I suppose the men must have been doing something by the old timbers. I understand they were putting in a new piece, and found it would not fit exactly, and we suggest that they must have taken away some of the old props before putting in the new, or else cut away the foot.

Continuing, Captain Thomas said the distance usually allowed for setting these baulks into the footwall was about a foot. He did not think the rock would be liable to splinter off. The distance allowed depended on the nature of the rock. He had never observed the rock to splinter off from the effects of blasting, because the foot was always put in firm ground. He did not think there would be any advantage in putting the tramway in the footwall and driving out cross cuts. They had been using iron instead of timber for the last 10 years in some parts of the mine in the narrow workings. He was afraid whether it would be strong enough for the wide workings, unless it was very heavy indeed. Of course, the advantage was that it would not decay.

In reply to a juror, Captain Thomas said it was not true that the run came away from the 375.

James Johns, principal Underground Agent, said the stull which had recently collapsed in the 412 consisted of 21 or 22 pieces of timber, 18 inches square, of pitch pine, and of an average length of about 33 or 34 feet, fixed at an incline of from 45 to 48 degrees, and from 2 to 3 feet apart. A second stull was being fixed similar to the first.

By Mr. Martin: He thought some of the ground had given away after having been given vent at the bottom. Two days before the accident he noticed a weakness on the western side. He saw Pollard, and told him that one of the pieces was bending. Pollard said he had noticed it, and as he knew the length of the piece, he would cut it at once. Witness told him that he would go down with him next morning and see it. He went down with Pollard, and the timber did not seem any worse. They looked over the timber together, and agreed as to what should be done. He thought the bending in the piece was due to the pressure of the hanging wall. He saw no other piece bending, and did not apprehend any danger whatever. He said to Pollard, "If you ever see anything in this stull wrong mind you do it while the timber is good, because the timber is liable to decay," and Pollard said he would. The pressure from the hanging wall varied very much in places. The bending in the piece would, of course, indicate a movement somewhere, and show that something was heavy somewhere. Pollard was an experienced man, and had been in Dolcoath for about five or six years. Previous to that he had had experience in timbering in other mines. He had been chief timberman in Dolcoath for about four years. It was Pollard who superintended the setting of all the timbers in this stull, and there were 16 men with him. There were two other experienced timbermen with him, who had also lost their lives. Witness explained in detail the method of setting the timber. He could not account for the stull at the 400 coming away. No doubt the ground in the back of the stope had given way in consequence of the stull-piece breaking first. They had found the stull-piece that they were repairing broken in pieces.

A Juror: It seems to me that if this one piece had only gone down more men would have been saved.

Captain Johns: I believe the men had a chance of escape, but that they thought they were safe enough under this stull. I do not see that any of them had any difficulty to escape except Charles White. I was told that Pollard was on the tram road holding a candle for one of the men to drive a nail, and that could be only three fathoms from the end of the stull. I believe that Pollard and the other men had such confidence in that stull that they went there for safety. Resuming, witness said the timbers forming the stull had only been in about 18 months, and were comparatively new.

Joseph Williams, one of the party working at the spot where the accident happened, said there were 17 men engaged in the work. They were putting in a new timber to make the place secure. A piece of timber had been sent down on the previous day. It was while they were in the act of replacing the timber that the run occurred. He, with eight others, started to run, and got away. The other men were nearer to the place of the accident, and had no opportunity of getting away. He did not know what the other men did when they heard the run.

The Coroner: What do you consider was the cause of the ground falling away?—Witness: I do not know; all I heard was a big noise overhead.

By Mr. Martin: He was standing on the south side when the run took place. After he heard the noise he ran, and noticed nothing falling or giving way. After he had secured a light he went back and found that the run had taken place, and the place filled up with stuff. They had got the timber into place ready to set, but there was a delay in getting the piece in at the foot. Pollard had been with witness and the other men, but left just before the run to see how the other men were getting on a little to the east. When they found they could not get the piece in, Pollard ordered White to make a little more room at the foot by working it away with a pick. Before there was time to make the room the accident happened. There was no one using a pick on either side that he noticed. He could not tell where the weight came from that carried away the timber, but he heard the roar of the stuff and rock falling away.

Albert George Roberts, who was also working with the party engaged in repairing the stull, said some of the men were told off to cut off some props. He was sitting down having lunch when he heard some ground fall away, and asked his companions what that was, and was told that it was only a little ground fallen away above. About two minutes afterwards he heard a further heavy fall, and the men engaged were covered with it.

By Mr. Martin: As he was going towards the stull, before the run, he heard someone using a pick very lightly.

David Jones, a mining student, said he had been working with Pollard and his party of men on the spot. After "croust" they tried to get the piece of timber in, but it jammed both at the top and bottom. This occurred twice, and it was at one time decided to leave it until the next day. He heard an alarm given, and with six others ran out of the western end. When the rush of air caused by the fall had subsided they went back again, and shouted to see if any of their comrades were near, but could neither hear or see anything. When they got to the top of the shaft they found the relief party ready to go underground. He had heard it said that the stoping was rather high, and the timbering hardly strong enough for it.

By Mr. Martin: He saw none of the timbers giving way. A little while before the run two men were making room at the foot of the piece with picks, and at the time of the run the piece was nearly in position, but was jammed.

William Gregory Arnall, mining student, said that for the last 18 months he had been working with Pollard in different parts of the mine. He did not see anybody working with a pick at the time of the accident, but just before that he heard a little stuff falling. Following that there was a big rush of ground, and he ran westward. He did not know actually whether any timber gave way or not.

William Sowden, miner, said that the accident occurred while they were endeavouring to fit in the stull piece.

William Brown proved finding the body of Jennings on the day following the run. On the Thursday night he discovered a little crevice, in which he crawled, and heard someone moaning. The moaning continued for some time, but after a few hours it ceased. He believed that to be Osborne. He also got near Davis, of Troon, and he spoke to him, and he was brought out alive the next morning. When witness discovered Jennings' body he found it fearfully mangled, and there was no doubt that he was killed instantly when the run occurred.

Mr. Joseph Samuel Martin, H.M. Inspector of Mines, said he went underground on the evening after the accident, and then found men engaged in doing all that seemed to the agents and themselves right and proper with a view to rescuing the entombed miners. While he was there the man Davies was spoken with, and he said that he was all right, and during that night he was rescued. On the other side, witness went to the place where Osborne was alleged to have been spoken to, and where his body was subsequently found, and where also Brown told him he heard groans. There he tried to get in to him, but there was a lot of small granite, and it was not considered safe to prosecute the search further in that direction. No further sign of life was heard or shown from Osborne. He went up to the top of the pile with Captain Johns, and found that some very large rocks had fallen away, and it occurred to

him that the hanging wall, or the lode itself, had given way to some extent, and that those rocks came from there. So far as he had been able to see, the timbering had been properly put in according to the custom of the mine and the judgment of the Agents, and that the men were certainly legitimately employed at the place with a view to the securing of it. He had no reason to imagine that there was any want of materials or of assistance to erect the necessary work. Of course it became, after this accident, a matter for the management to consider whether in the future the same method of timbering and securing would be the best, but he might say that similar accidents happened even in smaller areas than that. A very similar one occurred in a coal mine in a place not 5 feet high only a fortnight ago. There was only one life lost, but it was almost an exactly similar accident. For his own part, he should like to see some of these old "gunnisses" filled up, but it was a question whether it was practicable at so great a depth and under existing arrangements. In some of the mines in county Wicklow they carried the levels on the footwalls, and had their passes into the cross course for these large stopes. No doubt in the future that matter would receive consideration from Captain Thomas, and he would see if he could introduce any better arrangement which would be practicable and serviceable. The breaking strength of one of those balks that was now used in Dolcoath when the two ends were resting would be something like 120 or 140 tons, so that if they were carried for every 2 feet they would be so many times the more able to carry the weight upon them besides what the footwall would carry. They were also further strengthened by the use of "studdles."

The jury, without retiring, returned a verdict of "Accidental death," and passed a vote of sympathy with the relatives of the deceased men and the Agents of Dolcoath Mine.

Shaft Accidents.

These number six, resulting in a like number of deaths. This class of accident does not show a satisfactory decrease. In some cases the means provided for examining the shafts and for executing the work are unsatisfactory. The condition of some shafts is also unsatisfactory, and I would particularly refer to the accident at Drakewalls, where the shaft had got into such a state that it is a matter of surprise to me how work could have been carried on through it. The shaft has been repaired and strengthened since, and, I hope, is now in a safe and more workmanlike state. If the mine gives good prospects in depth, a new shaft should be sunk, and equipped with modern appliances. There are other mines where similar improvements are desirable, owing to the lodes being worked away almost from the very side of the shafts, thus creating great gaping cavities, which naturally weaken them.

Irruptions of Water.

The only fatal accident which comes under this heading in this district, during 1893, as having occurred in mines classed under the Metalliferous Mines Regulation Act, is the disastrous one which happened on the 10th January, in the Cargodna workings of Wheal Owles, resulting in the loss of 20 lives.

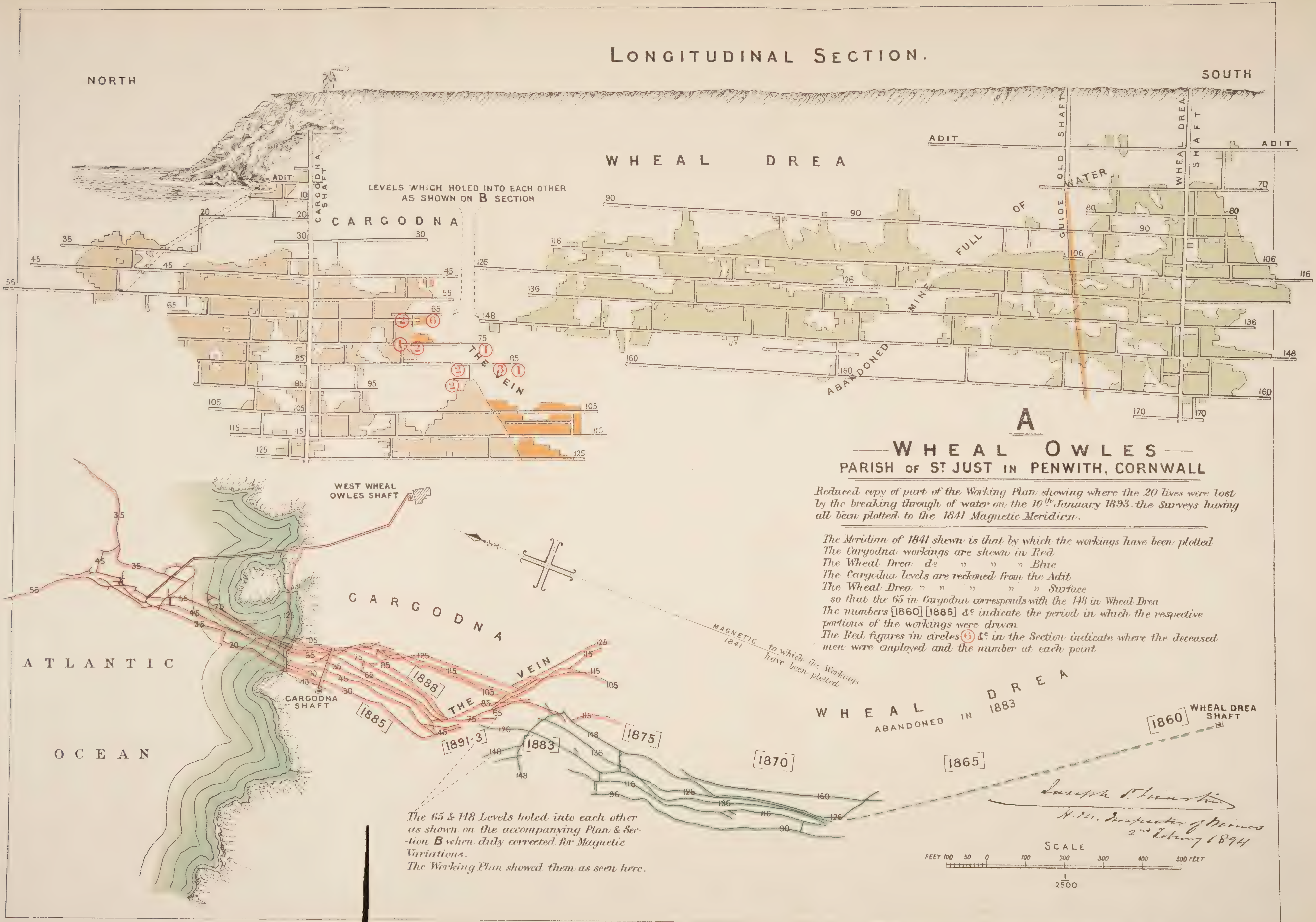
It occurred by the workings from the Cargodna shaft holing into the workings from the Wheal Drea Shaft, which had been standing full of water to the adit for years past.

The Wheal Owles "Sett" or Mine is situated on the western coast of Cornwall, north-west of St. Just, and south of the better known Botallack Mine. It consists of several shafts, with underground workings on several lodes, some of which are connected, while others are independent. These shafts are The Buzza, Wheal Boys, Cargodna, Corpus Christi, Wheal Drea, Wheal Edward, the Flat Work, Wheal Gendal, Wheal Grouse, Wheal Owles, West Wheal Owles, and others.

The Cargodna Shaft, which was commenced about 1883, is situated on the edge of the cliff, about a mile north-west of St. Just, and was the only shaft belonging to this mine working at the time the accident occurred, the workings in connexion with the other shafts being all full of water up to the adit level.

Wheal Drea Shaft, which ceased working in 1883, or thereabouts, lies approximately 400 fathoms south by east of Cargodna, and was sunk on the same lode, which runs north by west and south by east, with an east by north underlay.

The Cargodna northerly workings extend under the Atlantic, but had been standing for two or three years. The 30 fathom level of the southerly workings, about 80 fathoms from the shaft, cut a cross-course, having a south-east and north-west bearing, and underlying to the north-east, the intermediate levels doing so at intermediate distances. The several levels follow the cross-course to the south-east from where they cut it.



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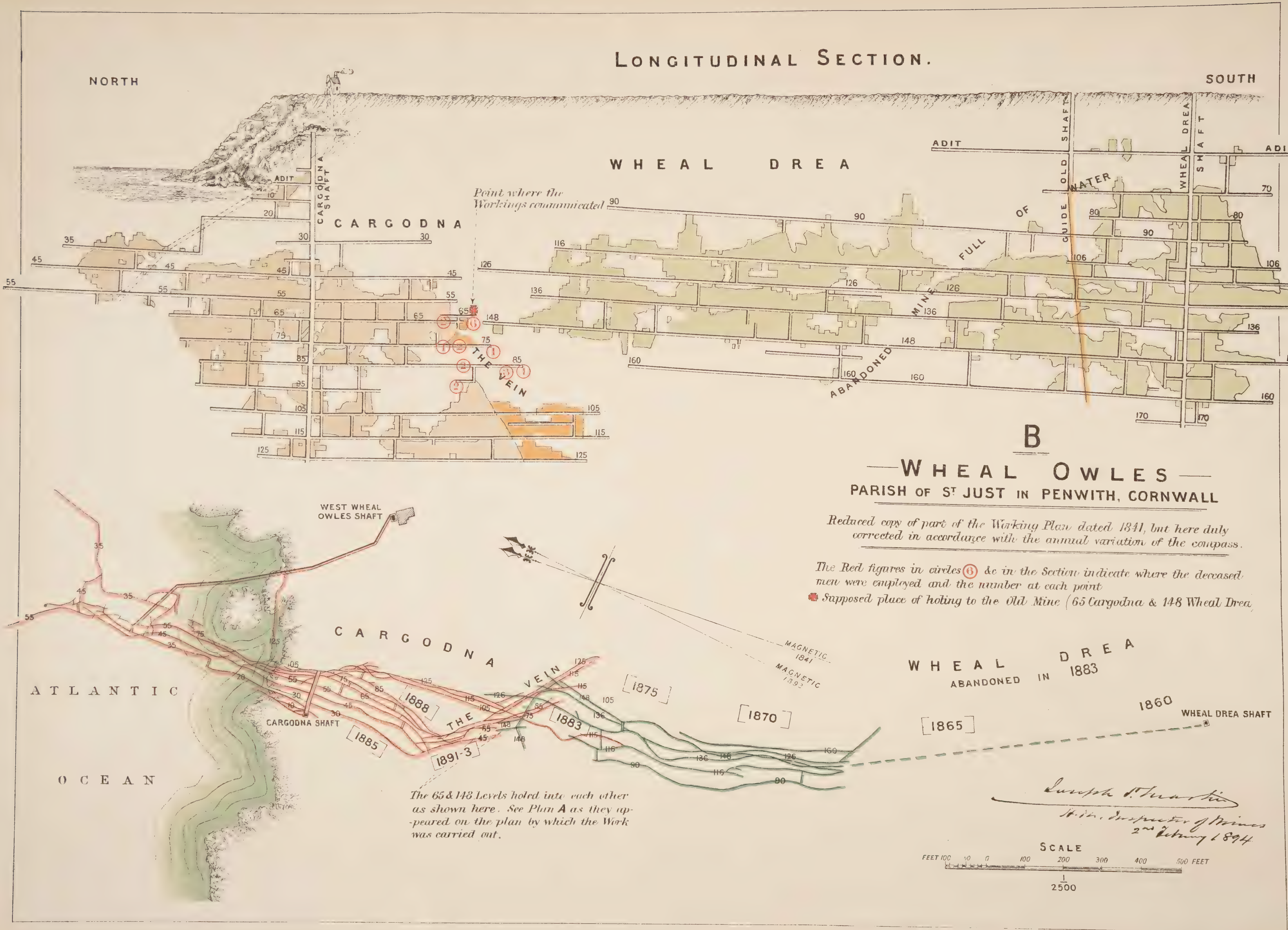

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The Wheal Drea northerly workings likewise cut this same cross-course vein, but more to the south-east than the Cargodna workings, and the levels follow its course to the north-west.

Thus the two sets of levels approached each other in the same vein, which was not shown to be the case in the working plan.

The levels in the Cargodna shaft are reckoned from the adit, whereas the levels in the Wheal Drea shaft are reckoned from the surface; consequently the 65 and 148 fathom levels correspond in depth respectively, and it was clearly the holing of the 65 into the 148 which brought about the inrush of water.

The accident appears plainly to have been the result of an inaccurate plan, caused by the surveys over a number of years having all been plotted to the same magnetic meridian, namely, that of 1841, in which year the plan was originally prepared. This error caused the Wheal Drea workings to be shown too much to the south and the Cargodna too much to the north, as well as being apparently on different veins, and going in different or opposite directions.

In order to clearly illustrate the error brought about from this important oversight, I have had the accompanying reduced plans (A. and B.) prepared by Messrs. Henderson and Son, of Truro.

(A.) is a reduced copy of the working plan of the mine as it appeared at the time of the accident.

(B.) is a reduced copy of the working plan duly corrected, by making allowance for the variation of the magnetic meridian.

On (A.) it will be seen that the Cargodna, 65 fathom level, and the Wheal Drea, 148 fathom level, are shown to be 22 or 23 fathoms apart, and going in almost opposite directions, as well as being apparently on different veins, whereas on (B.) they are shown to be only about one fathom apart, going towards each other in the same vein. As will be seen from the statements further on, which were made to me the day after the accident, there seems no reason to doubt that the 65 fathom level of the Cargodna workings holed into the 148 fathom level of the Wheal Drea workings, and thus brought about the accident.

The numbers marked on the sections in red, with a circle around them, indicate the points where the deceased were at work, and the number of persons at such points. It will thus be seen that there were eight lost in the 65 fathom level, four at the 75 fathom level, eight at the 85 fathom level, and two in the 95 fathom level, which was being driven back to communicate from the bottom of a winze below the 85 fathom level.

On the morning of the accident (10th January) 40 men went underground about 7 a.m., and had been about two hours in the mine when the accident occurred. All those employed in the 55 fathom level came out safely. None of the eight employed in the 65 came out. Of the eight employed in the 75, four (two trammers and two fillers) came out safely, having been close to the shaft when the inrush occurred; while none of the eight employed at the 85 came out.

Having learned during my inquiry that, when plotting the surveys, no allowance had been made for the variation of the magnetic meridian, and that they were all laid down from the meridian originally marked on the plan when prepared in 1841, it at once appeared to me that the accident was to be accounted for in this way, and I consequently requested that a corrected plan should be prepared, which was done by Messrs. Henderson and Son, of Truro, and of which the accompanying plan (B.) is a reduced copy. This resulted as anticipated, and demonstrated satisfactorily how and where the mistake arose. I called at the mine when passing through St. Just, on the 28th September, previous to the accident, being accompanied by Mr. E. E. V. Stokes, and saw Mr. Thomas Tregeare, the chief Agent, in the absence of the Manager, Mr. Boynes, who has been invalided and confined to his room for some time back. Having had the position of the workings pointed out to me and explained on the plan in the Count House, I drew attention to the fact that they appeared to be working between two ranges of old workings containing water, and in no very great width of ground, and I mentioned that they would need to be very careful. I also asked if they were quite sure of the accuracy of their plans, and was answered in the affirmative, Captain Tregeare saying that he was quite so, and that the manager was most particular about the plan, which he allowed no person but himself to interfere with, as he was rather "plan-proud." Captain Tregeare showed us a rough working plan of the Cargodna workings, which he kept up himself, for his own guidance, but this did not include the old working from Wheal Drea. Not feeling satisfied that I altogether grasped the exact positions of the relative levels in the two sets of workings, owing to the different datum lines from which they are reckoned, I requested Mr. E. E. V. Stokes to again visit the mine, and go into the plans thoroughly, to see exactly how they stood. He accordingly visited the mine on the 1st November, and does not appear to have had any

doubt raised in his mind in regard to their accuracy. He had also been underground and made a general inspection of the mine on the 18th July.

Having, in accordance with my instructions, reported to you the circumstances attending the accident, you, in view of the general demand from the neighbourhood for a public inquiry, directed that proceedings should be instituted against the persons responsible for the inaccuracy of the plans. The manager was consequently, on the 5th April, charged before the justices, Messrs. the Rev. John Tonkin, J.P., and C. C. Ross, J.P., at the West Penwith Petty Sessions (Penzance), with having contravened the 19th section of the Metalliferous Mines Regulation Act, 1872, by not keeping an accurate plan of the underground workings of the mine.

The defendant being confined to his bed by continued illness was represented very ably by Mr. Bodilly, solicitor, of Penzance, who set up the somewhat peculiar defence that he (defendant) was ignorant of the effect of the variation of the magnetic meridian, and that consequently under the exemption which is expressed in the section he was not liable.

Except as a technical and legal defence, I very much question the defendant admitting such to be the case, as it is too fundamental a principle for a person of his apparent ability and experience in planning to be ignorant of, and I think it is due to the manager to state that the plan which was prepared by him in 1841, when the mine was first commenced, 30 years before it was required by legal enactment, was well got up, neatly drawn, and apparently highly creditable in all respects other than the unaccountable oversight of omitting to allow for the variation of the magnetic meridian.

The Bench took time to consider their decision, which I give here at full length, as reported in the "Western Morning News" of Monday the 17th April.

THE WHEAL OWLES DISASTER.

Magisterial Decision.

At a special sitting of West Penwith magistrates, at Penzance, on Saturday, Rev. John Tonkin and Mr. C. C. Ross gave their decision in the case heard on the 5th inst. against Mr. Richard Boyns, purser and manager of Wheal Owles Mine. The charge was of having kept inaccurate plans of the mine. Mr. A Archer, of Truro, prosecuted on behalf of the Treasury; Mr. G. L. Bodilly, of Penzance, defended.

The Chairman said in this case the defendant, as Owner or Agent of Wheal Owles, was charged with failing to keep an accurate plan of the workings of the mine in accordance with the 19th section of the Metalliferous Mines Act, 1872. The facts were very simple, and indeed were practically admitted. The defendant was not only one of the principal owners of, or shareholders in, but was also the Purser and principal Agent of the mine. He had himself kept the plan of the workings of the mine, and such plan is admitted to have proved seriously inaccurate. The defence raised was that defendant had been ignorant of the inaccuracy, and that under the section such ignorance was a good defence. The section in question (after providing that the Owner or Agent shall keep an accurate plan, and that he shall on request produce such plan to the inspector) continues thus:—"If he (1) fails to "keep such plan as is prescribed by this section; or (2) wilfully refuses to produce it; or (3) "wilfully withholds any portion of such plan; or (4) conceals any part of the workings of "the mine, or produces an imperfect or inaccurate plan, unless he shows he was ignorant of "such concealment, imperfection, or inaccuracy, he shall be guilty of an offence against the "Act," and for the defence it was very ably contended that the exception (*i.e.* the words "unless he shows he was ignorant," &c.) applies not only to the fourth or last division, but also to the first and other preceding divisions of the offences under the section, and that, therefore, ignorance in this case constituted a good defence. As to the facts relating to such ignorance, it was not for a moment suggested, even by the prosecution, that there was a wilful intentional inaccuracy; the inaccuracy in question seems to have arisen from defendant having left the plan without making any allowance for the continuous magnetic variations, the result being that the plan was wrong to the serious extent of considerably over 100 feet in the distance shown by it, in the present and older set of workings. We have no hesitation in saying that we do not believe, and indeed the prosecution did not allege, that defendant was aware of to what great an extent the omission to make the necessary allowance had rendered his plan inaccurate; but his attention had been called on more than one occasion to the existence of magnetic variations and the fact of their affecting plans, and if it were necessary for us to decide the point, we should feel some difficulty in finding that we were satisfied that the defence had shown "ignorance" within the meaning of the section. In arriving at a decision as to whether any offence against the Act has been committed at all,

as distinguished from the question of the degree of, or the punishment for, the offence, if any, we have endeavoured not to allow ourselves to be influenced, on the one hand by the fact of the very terrible accident referred to by the prosecution, or, on the other hand, by the facts as to the defendant's integrity, his well-known interest in the mine and the miners, the deep pain occasioned to him by the accident, and his present weak state of health, which were mentioned by his solicitor, and which are well known to us, and cannot but call forth sympathy with him at this time. After a careful consideration, however, of the whole scheme and spirit of the Act, and of the wording of the section itself (which it must be admitted is obscurely drawn), and of the other sections (particularly section 32, which throws some light on it, and the distinctions made in places between "offences" and "wilful offences"), we are of opinion that as a matter of law the words "unless he shows he was ignorant," &c., do not apply to the first offence under the section, and that ignorance, even if proved up to the hilt, would not in this case be a good defence, and that, therefore, an offence has been committed against the Act by the defendant in his character of Agent of the mine, and we inflict a penalty of 15*l.*

Mr. G. L. Bodilly: I suppose you will have no hesitation in granting me a case. This is a question of law, and I probably shall ask you to state a case for the opinion of a higher court.

The Chairman: Certainly not.

Mr. Bodilly also pointed out that it was necessary for the defendant to personally enter into recognisances to prosecute the appeal, and asked whether, if he decided to do so, the magistrates would take the recognisances at the defendant's house, because it was absolutely impossible for him to leave the house, and the magistrates decided to adopt that course if necessary.

The Chairman: Does he intend to appeal?

Mr. Bodilly: I must consider that, I cannot say offhand what he will do.

The appeal was not proceeded with.

As no inquest could be held, I give the following statements from the men employed in the mine.

11*th January* 1893.

Re Wheal Owles disaster, which occurred on 10th January.

The following statements were made to me as H. M. Inspector of Mines on the day after the occurrence in the count-house, at the mine:—

James Hall: I am a miner, and have worked at Wheal Owles for the last 17 years. I was at work in the mine yesterday at the 55 fathom level. I went down Cargodna shaft, leaving the surface about 7.30 a.m. It took me about a quarter of an hour to reach the 55 fathom level. I had started work about half an hour in my working place (a stope on the back of the 55 fathom level, in the Cargodna lode) when I heard a noise, which I first thought arose from a sollar giving way. I had two boys with me and I called to them to jump down to the level from the sollar on which they were working, and I did so myself also. I then recognised that it was water which was rushing down through the stopes, &c., to the levels below. I saw no water as it was at a lower level it came in, but I cannot say at which, of my own knowledge. Our lights were extinguished by the air current. I got the boys into the waggon and pushed it out to the shaft. It thus being on rails acted as a guide for me. The boys then took the ladders and climbed safely to grass. I went down three ladder lengths below the 55 fathom level to see if I could assist anyone and remained down about 20 minutes, after which I climbed to grass. There was no water falling down the shaft. The other men and trammers working near the end of the 55 came out with us safely. I saw no person below the 55. Those who were saved from the 75 had come up to the 55 before I got to the shaft. I did not actually see water in the mine, but I know it was water because I dropped a stone down in the shaft and heard the splash. The water at that time was perhaps about 13 fathoms below the 55. I climbed leisurely, and dropped a stone about every 10 fathoms, to see where the water was, and I think it was about 15 fathoms below me. It seemed for some time to rise nearly as fast as I climbed. At the adit level I met Capt. Tom Tregeare on his way down. I asked him what the water was and he said he did not know. I told him that it was rising quickly. He then went down to see where it was, and I went up to grass. I had no knowledge nor idea of any danger from water. There was no rumour of anysuch among the men; had there been we would have ceased work long since.

Benjamin Hoskin: I am a miner, and work at Wheal Owles. I have worked there about 33 years out of the last 36. I was at work yesterday at the 55 fathom level of the Cargodna shaft, having entered the shaft about 7.30 a.m. My companion and I were about starting to repair a "tram hole," "shoot" or "mill," as they are called, having removed a couple of waggons of stuff out of our way, when I heard a noise like an explosion. I thought at once that it was water breaking in. I called to my comrades to come on. They, however, went inwards along the level, whereas I went outwards and made my way to the ladders in the shaft. They (my comrades) afterwards came out with others. They went inwards in consequence of getting confused, as we were all in the dark owing to the rush of wind caused by the water extinguishing our lights. I made my way up to the 45, where I saw three men, one of whom had a light. I called to them to come on quickly, and went straight up to grass myself. I thought the water was closer to me than proved to be the case. I did not actually see the water. I knew it to be water from the rush of air and hearing it pouring down the workings. I did not know that any of the workings were near dead water. Had I known it I would not have worked there. The water came from below the 45. I cannot say at what point it broke in, but I think it came at the 65 fathom level.

Thomas Tregeare: I am chief underground Agent at Wheal Owles, and have had charge of the mine for the past 8 years. I have known the mine about 42 years, during the whole of which period I have been engaged at it. Captain Richard Boynes is the manager, and I receive my instructions from him. I report to him. He has been invalided for the last two or three years, and has been unable to visit the mine. The plans are surveyed or dialled by me, and I have plotted the present workings (Cargodna) on a small rough plan for working purposes. The workings are laid down by Mr. Boynes on the large plan of the mine. The plan which I plot for my own guidance does not show the position of the old workings. The large plan shows the workings of Cargodna (which is the part of Wheal Owles now working), The Buzza, Flat Work, Wheal Boys, Wheal Grouse, Corpus Christi, Wheal Edward, Wheal Drea, and Wheal Gendal. These have all been abandoned, and full of water up to the adit level for years. The Wheal Drea and Wheal Owles workings are the nearest to Cargodna workings, and the nearest parts of them lie respectively to the west and east of the Cargodna workings. The latter are, it may be said, in between them in a range of ground about 40 fathoms wide. The course of these lodes runs about north and south. The Cargodna present workings run southwards about 50 to 80 fathoms, the deeper levels being the longer, where they intersect a vein which bears about south-east and north-west and on which the levels have been extended towards Wheal Owles.

I have surveyed or dialled the workings about every four months, and, being aware of the presence of water in the old workings, I took what I considered to be all necessary precautions. I have talked the matter over with Captain Boynes, and he always cautioned me about being careful where we were driving to, and not to drive too much to the south. I was through all the working places on Thursday last (5th January) and the other agent (John Laggna,) was through them on Friday. We neither of us noticed any indications that we were approaching workings containing water. We took the plan of the old workings to be correct, and worked accordingly. They were partly surveyed or dialled by me, and partly by my predecessors. I also took the workings of Cargodna to be correct as laid down on the plan by the manager. In making my surveys and plotting them I have not made much allowance for the variation of the needle (magnetic meridian). I have not checked my surveys by tieing from an upper level in the shaft, down through the far in-workings to the lower levels, back along them, and up the shaft to the starting point. When plotting my surveys I make allowance for the measurements on the underlay in accordance with the angles taken by means of a quadrant. This was my practice in the old (Wheal Drea) workings also. I cannot say what the practice of my predecessors was. I knew two or three of my predecessors; they were practical men, who rose from being miners. Their experience was, I believe, local, and only at this mine in some instances, while in others they had experience as Agents at other mines. I have myself been dialling at this mine more or less for 15 years. I produce my working plan, already referred to. There is a longitudinal section, but there is no transverse section.

Yesterday, the morning of the accident (Tuesday, 10th January), I was going underground with Captain Laggna for the purpose of measuring up the men's work. Captain Laggna left me at the count-house changing my clothes, and he went on to the engine-house in order to change his. We were to meet at the shaft and go underground together. On my way to the shaft I met the shaftman (Newton), who informed me of a split pump in the West Wheal Owles Shaft, which delayed me about a quarter of an hour or 20 minutes. After

leaving him I only had proceeded about 20 yards on my way to the shaft, when I saw Captain Laggna calling me to come on in a hurry. I ran on to meet him, and he then told me that they had holed the water at the 75. He said that while he was at the top of the shaft the men came up and told him what had occurred. I went down the shaft along with the pitman, and met some men coming up. We went down two or three fathoms below the 30, and found that the water was up to that point. We then returned to the surface, and I sent the pitman down Wheal Owles Shaft to see if anyone had escaped that way, but he found no one. I then felt certain that all who worked below the 30 fathom level who had not already escaped had lost their lives. I then took steps to ascertain the names of those who went to work that morning and those who escaped. I found that 40 had gone down, of whom 20 escaped, leaving 20 as the number of those who had perished. There were 24 persons employed below the 55 fathom level, of whom four escaped from the 75 fathom level, as they happened to be working close to the shaft at the time. It is, in my opinion, into the Wheal Drea workings that we holed, and from which the water has come. These workings are connected with the Boscean Old Workings, so that, in order to pump out the water from the Cargodna workings, it would be necessary to provide for the former inflow of water to these workings as well as the inflow to the Cargodna, together with a margin for pumping out the water which has accumulated in the workings. The pumps at Wheal Drea when it was working were 8-inch plungers with $8\frac{1}{2}$-feet stroke, and to keep the feeder it had to be worked three and a half to four strokes per minute. At Boscean there were 9-inch plungers with 10-feet stroke, and to keep the feeder the engine worked seven strokes per minute. The feeder at Cargodna (present workings) kept the 8-inch plungers with $5\frac{1}{2}$-feet stroke, working four strokes per minute.

I am personally acquainted with the foregoing group of workings, which, with others, constitute the mine known as Wheal Owles. The owners are the Wheal Owles Adventurers, a cost book company, but the owners are also known as Thomas Bolitho, Sons, and others.

The water rose about 6 feet between 11 a.m. yesterday and 11 a.m. to-day; it consequently will now fill up slowly in accordance with the amount of the feeders referred to, as the water appears to have found its level in both sets of workings.

Wm. Charles Granville: I am a filler, working at Wheal Owles. I was in the mine yesterday when the water burst in. I was engaged, along with Richard Blewett, in the Platt close to the shaft and under the 75 fathom level. About nine o'clock I heard a roar like thunder. Our candles were extinguished. We, made for the level (the 75), on reaching which I followed Blewett to the shaft, and we climbed to the 65 fathom level. Blewett there tried to light a candle, but his matches were extinguished by the wind. We made our way up to grass in the dark. No water reached where I was. We made our way out as quickly as we could, thinking our lives were in danger. I know nothing further with regard to the accident.

Richard Lutay: I am a trammer, working at Wheal Owles. I was at work there yesterday in the 75 fathom level. I happened to be close to the shaft about 9 o'clock, when I heard a noise as if caused by a waggon in the 55 fathom level. I then heard a rush like water into our level. I then heard a louder sound, and a rush of wind put out our lights. We (my comrade and I) were going in along the level at the time, and had got about 10 fathoms in. We both turned back, and by the time we reached the Platt at the shaft the water caught us up. I shouted to Grenfell and Blewett, who were down in the Platt filling our stuff into the skip, and they came up. We were all in the dark. We got into the ladders as soon as we could and came up to grass, but before I reached the ladders the water was pouring down the shaft from this level. I saw water coming on the level before I lost my light. It seemed to gradually increase, but did not reach us in a big body. I could hear it pouring down through the gunnisses further in. This level was quite dry previously, and we had only been out with a full waggon about five minutes from the end of the level. A strong rush of wind accompanied the water.

TABLE 1.—FATAL ACCIDENTS IN RELATION TO PERSONS EMPLOYED.

The number of persons employed, the number of deaths by accident, the ratio of accidents to persons employed, and the death-rate per 1,000 for each year since the Metalliferous Mines Regulation Act came into force, are shown by the following tabular statement:—

Year.	Number of Persons employed.	Number of Deaths by Accident.	Number of Persons employed for each Death.	Number of Deaths per 1,000 Persons employed.
1873	32,326	62	521	1·918
1874	27,347	55	497	2·011
1875	24,380	53	460	2·174
1876	23,028	24	960	1·042
1877	21,795	38	574	1·743
1878	17,667	26	680	1·471
1879	15,865	18	881	1·134
1880	17,892	34	526	1·900
1881	20,161	28	720	1·388
1882	20,513	34	603	1·657
1883	18,362	40	459	2·178
1884	16,483	17	969	1·031
1885	15,633	20	781	1·279
1886	14,700	26	565	1·769
1887	14,371	17	845	1·183
1888	15,197	27	563	1·777
1889	14,817	24	617	1·619
1890	14,313	13	1,101	0·908
1891	13,317	23	579	1·659
1892	12,740	14	910	1·099
1893	12,092	39	310	3·225
Totals for the 21 years - -	382,909	632	14,121	—

To allow of comparison with the present district I have in the above table combined the persons employed, the fatal accidents, and the deaths which occurred in the Nos. 12 and 14 Districts previous to 1892, in which year those districts were amalgamated to form the district as at present constituted.

TABLE II.—FATAL ACCIDENTS AND DEATHS (No. 14 DISTRICT).

The Fatal Accidents and Deaths in the district, as at present constituted, are tabulated under their respective headings for the 10 years ending 1893 as follows:—

Cause of Accident.	Number of Fatal Accidents.											Average for 11 years.	Number of Deaths resulting therefrom.											Average for 11 years.
	1883.	1884.	1885.	1886.	1887.	1888.	1889.	1890.	1891.	1892.	1893.		1883.	1884.	1885.	1886.	1887.	1888.	1889.	1890.	1891.	1892.	1893.	
Falls of ground	7	2	5	2	4	6	10	3	6	4	4	4·81	[illegible]	2	5	2	4	7	10	3	6	4	11	5·73
In Shafts.																								
Overwinding	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—
Ropes and chains breaking	3	—	1	1	1	—	—	—	—	—	—	—	14	—	1	1	1	—	—	—	—	—	—	—
Whilst ascending or descending by machinery	—	—	2	1	2	2	2	2	2	—	—	—	—	—	2	1	2	2	2	2	2	—	—	—
Falling into shaft from surface	—	—	1	—	—	1	—	—	—	—	—	—	—	—	1	—	—	1	—	—	—	—	—	—
Things falling from surface	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—
Falling from part way down	4	3	2	3	1	4	4	2	5	—	2	—	4	3	2	3	1	4	4	2	5	—	2	—
Things falling from part way down	1	—	—	1	—	2	—	1	1	—	1	—	1	—	—	1	—	2	—	1	1	—	1	—
Miscellaneous in shafts	—	2	—	2	2	—	2	—	1	—	3	—	—	2	—	2	2	—	2	—	1	—	3	—
Totals in shafts	8	5	6	8	7	10	8	5	9	—	6	6·54	19	5	6	8	7	10	8	5	9	—	6	7·54
Miscellaneous Underground.																								
Explosions of gunpowder, &c.	2	5	2	4	2	4	4	1	—	1	—	—	3	5	3	5	2	4	4	1	—	1	—	—
Suffocation by gases	—	1	—	—	—	—	—	—	—	1	—	—	—	1	—	—	—	—	—	—	—	1	—	—
Irruptions of water	1	—	—	—	—	—	—	—	1	—	1	—	2	—	—	—	—	—	—	—	2	—	20	—
Falling into water	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
On inclined planes	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
By trams and tubs	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—
By machinery underground	—	—	1	—	1	1	—	—	—	—	—	—	—	—	1	—	1	1	—	—	—	—	—	—
Sundries underground	3	2	4	6	2	2	—	1	2	5	1	—	3	2	4	6	2	2	—	1	2	5	1	—
Totals miscellaneous underground	6	8	7	11	5	7	4	2	3	7	2	5·63	8	8	8	12	5	7	4	2	4	7	21	7·82
On Surface.																								
By machinery	3	1	—	2	—	—	—	—	1	1	—	—	3	1	—	2	—	—	—	—	1	1	—	—
Boilers bursting	—	1	1	1	—	—	—	1	—	1	—	—	—	1	1	1	—	—	—	3	—	1	—	—
Miscellaneous	1	—	—	1	1	3	2	—	2	1	1	—	1	—	—	1	1	3	2	—	3	1	1	—
Totals on surface	4	2	1	4	1	3	2	1	3	3	1	2·27	4	2	1	4	1	3	2	3	4	3	1	2·54
Gross totals	25	17	19	25	17	26	24	11	21	14	13	18·36	40	17	20	26	17	27	24	13	23	14	39	23·63

The schedules of fatal and non-fatal accidents which occurred during the year, as reported to me, are appended.

I have, &c.
(Signed) JOSEPH S. MARTIN.

To the Right Hon. H. Asquith, Q.C., M.P.,
Her Majesty's Principal Secretary of State,
Home Department, Whitehall, London, S.W.

Fatal Accidents.

METALLIFEROUS MINES REGULATION ACT.

A LIST of the FATAL ACCIDENTS, and DEATHS (arising therefrom within one year and a day from the date of the Accident), which occurred in and about the Mines of the SOUTH-WESTERN METALLIFEROUS MINING DISTRICT during the Year 1893.

No. of Accidents.	Date.	Hour of Shift when Accident happened.	Name of Mine.	Where situate.	Owner's or Company's Name.	Persons killed.	Reputed Age.	Occupation.	Cause of Death, and Remarks.	Lives lost. Explosions of Firedamp.	Lives lost. Falls of Ground.	Lives lost. In Shafts.	Lives lost. Miscellaneous Underground.	Lives lost. Above-ground.
1	1893. Jan. 10	2nd	Wheel Owles -	St. Just -	Thos. Bolitho, Sons, and others.	Thomas Allen -	23	Miner -	Irruption of water from Old Wheal Drea workings, which belong to the same mine. The plan being inaccurate, misled the agent as regards the relative position of the workings. (*See* page 56.)	–	–	–	20	–
						Lewis Wilkins Blewett.	20	Trammer						
						Peter Dale - -	24	Miner -						
						William Davey -	18	Trammer						
						William Eddy -	20	Miner -						
						Thomas Ellis - -	36	Ditto -						
						John Edwards -	37	Ditto -						
						John Grose - -	54	Ditto -						
						Thomas Grose -	22	Ditto -						
						John Olds - -	25	Ditto -						
						William Roberts -	24	Ditto -						
						James Rowe -	22	Ditto -						
						John Taylor -	30	Ditto -						
						Mark Taylor -	22	Ditto -						
						Charles Thomas -	38	Assistant Trammer						
						James Thomas -	25	Miner -						
						William John Thomas	15	Wheeler-						
						Edward White -	44	Miner -						
						James Williams -	25	Ditto -						
						Richard Williams -	27	Ditto -						
2	Mar. 4	5th	Dolcoath -	Camborne	The Dolcoath Mine Adventurers.	John Kemp - -	20	Ditto -	While engaged on a staging in the New East Shaft repairing the skip road at the 100-fathom level, he appears to have over-balanced and fallen away to the 125-fathom level, where his dead body was found.	–	–	1	–	–

List of Fatal Accidents, &c.—*continued.*

No. of Accident.	Date.	Hour of Shift when Accident happened.	Name of Mine.	Where situate.	Owner's or Company's Name.	Persons killed.	Reputed Age.	Occupation.	Cause of Death, and Remarks.	Lives lost. Explosions of Firedamp.	Falls of Ground.	In Shafts.	Miscellaneous Underground.	Above-ground.
3	1893. Mar. 31	2nd	Carn-Brea	Illogan	The Carn-Brea Mine Adventurers.	Peter Collins	40	Timberman.	While engaged repairing the Highburrow Shaft at the 50-fathom level, he appears to have overbalanced himself and fallen away to the 130-fathom level, where his dead body was found.	–	–	1	–	–
4	Apr. 12	6th	South Wheal Frances United.	Ditto	The South Wheal Frances United Adventurers.	John William Wicks	21	Miner	While engaged filling a tram at a "pass," some of the timber gave way and fastened him by the foot, so that he could not escape. The mineral in the pass continued running in as it was cleared away, and prevented his release for 22 hours. He died in hospital the following morning from exhaustion (*see* body of Report, page 47).	–	–	–	1	–
5	" 17	4th	West Wheal Frances.	Ditto	The West Wheal Frances Mine Adventurers.	W. H. Parkins	20	Ditto	Fall of ground from the hanging wall. The survivors allege they tried it with a sledge a few minutes before.	–	1	–	–	–
6	July 18	9th	West Kitty	St. Agnes	The West Kitty Mine Adventurers.	William Peters	57	Lander	While engaged tipping ore into the dressing floors, from a gangway, the tram toppled over, and he fell with it 17 feet to the level of the ground and was killed. A chain was provided originally to prevent such an occurrence, but its use had been neglected for some time past.	–	–	–	–	1

List of Fatal Accidents, &c.—*continued.*

No. of Accident.	Date.	Hour of Shift when Accident happened.	Name of Mine.	Where situate.	Owner's or Company's Name.	Persons killed.	Reputed Age.	Occupation.	Cause of Death, and Remarks.	Lives lost. Explosions of Firedamp.	Lives lost. Falls of Ground.	Lives lost. In Shafts.	Lives lost. Miscellaneous Underground.	Lives lost. Above-ground.
7	1893. July 19	1st	Drakewalls	Gunnislake	The Drakewalls Mining Co., Limited.	Wm. Henry Rundell	35	Pitman	Being engaged in shaft work with others, he was ascending part way in the skip when a stretcher ($4\frac{1}{2}$ feet and 6 inches × 8 inches) fell down and struck him, resulting in his death next day. The shaft was in a scandalous condition, and might well frighten anyone from keeping it going as a working shaft. I am glad to say that extensive repairs have been effected, and I hope it will be thoroughly secured before much other work is carried out.	–	–	1	–	–
8	Sept. 20	6th	Carn-Brea	Illogan	The Carn-Brea Mine Adventurers.	John Halls	20	Miner	A small fall of ground, due to an "air-blast" (*i.e.*, the stone being in a state of tension burst off), fractured his skull.	–	1	–	–	–
9	" 20	5th	Dolcoath	Camborne	The Dolcoath Mine Adventurers.	Richard Davies William Osborne John Jennings Frederick Harvey James Adams Charles White John Pollard Richard James	20 37 20 27 27 58 35 32	Ditto Ditto Ditto Ditto Ditto Timberman Ditto Ditto	Owing to a large run of ground the "stull" in the back of the 412-fathom level was carried away, and caught these men under it, as well as entombed another for 36 hours, when he was released. They and others were at the time engaged strengthening it (*see* body of Report, page 52).	–	8	–	–	–
10	Oct. 31	9th	Kingsteignton	Kingsteignton	Watts, Blake, Bearne, & Co.	James Walters	40	Miner	A prop which was being lowered into one of the shallow clay pits slipped through the chain hitch and, striking his head, caused immediate death.	–	–	1	–	–

List of Fatal Accidents, &c.—*continued.*

No. of Accident.	Date.	Hour of Shift when Accident happened.	Name of Mine.	Where situate.	Owner's or Company's Name.	Persons killed.	Reputed Age.	Occupation.	Cause of Death, and Remarks.	Lives lost. Explosions of Firedamp.	Falls of Ground.	In Shafts.	Miscellaneous Underground.	Above-ground.
11	1893. Nov. 4	1st	West Wheal Frances.	Illogan	West Wheal Frances Adventurers.	William Martin	55	Miner	Crushed in the shaft between the (skip) runner and the engine or pump rod, about 15 fathoms above the 180-fathom level. He apparently had no business to go there. This indicates the necessity for increased discipline and supervision.	–	–	1	–	–
12	„ 18	7th	Botallack	St. Just	The Botallack Mine Adventurers.	Wm. Henry Lawry	16	Assistant to Timberman.	He was assisting the shaftman near top of shaft; he appears to have slipped on the top ladder and fallen a very few feet. He was picked up dead, his neck having been broken. The fall was not actually seen, although the shaftman was working only a few feet from him. There was a hurricane blowing at the time, and the shaft is close to the cliffs, so that conversation could only be heard with difficulty where they were. The wind may have caused him to slip.	–	–	1	–	–
13	„ 18	4th	Corsham Down	Corsham	Yockney & Co.	William Sheevring	32	Underground quarryman.	Fall of roof or ceiling, 12 feet × 7 feet × 10 to 20 inches thick. The stone was loose on three sides and the top, and broke off at the remaining one. The	–	1	–	–	–

List of Fatal Accidents &c.—*continued.*

No. of Accident.	Date.	Hour of Shift when Accident happened.	Name of Mine.	Where situate.	Owner's or Company's Name.	Persons killed.	Reputed Age.	Occupation.	Cause of Death, and Remarks.	Lives lost. Explosions of Firedamp.	Lives lost. Falls of Ground.	Lives lost. In Shafts.	Lives lost. Miscellaneous Underground.	Lives lost. Above-ground.
	1893.								men in these stone mines, as well as gangers and foremen, frequently trust the visible joints to an undesirable extent. They allege that they find by long experience that the beds sink and lock themselves quite safely after a short time.					
									Total lives lost - -	—	11	6	21	1
									Total fatal accidents - -	—	4	6	2	1

Non-fatal Accidents.

METALLIFEROUS MINES REGULATION ACT, 1872.

LIST OF NON-FATAL ACCIDENTS causing serious personal injury in the South-western District during the year 1893.

No. of Accident.	Date.	Hour of Shift when Accident happened.	Name of Mine.	Where situate.	Owner's or Company's Name.	Persons injured.	Reputed Age.	Occupation.	Remarks.	Persons injured. Falls of Ground.	In Shafts.	Miscellaneous Underground.	Above-ground.
1	1893. Jan. 17	5th	Dolcoath	Camborne	The Dolcoath Mine Adventurers.	Samuel Rodda James Osborne James White	55 19 42	Pitman Ditto Ditto	Fall of loose stone from the side of main engine shaft, while repairing the timber.	–	3	–	–
2	„ 19	1st	Wheal Owles	St. Just	Thos. Bolitho, Sons, and others.	James Furze	17	Pitman's assistant.	In stepping on to the ladder at the surface, to accompany the shaftman underground, he slipped and, falling about 20 feet, sprained both ankles.	–	1	–	–
3	„ 24	3rd	Tincroft	Illogan	The Tincroft Mine Adventurers.	Joseph Hooper	21	Miner	In order to return to his work after blasting, he placed a ladder against the edge of the stope, and in doing so displaced a loose stone, which fell and injured him.	–	–	1	–
4	„ 24	6th	Devon Great Consols	Tavistock	The Devon Great Consols, Limited.	George Turner, Junr.	16	Ditto	While ascending the shaft by the ladders he slipped and fell 5 or 6 fathoms.	–	1	–	–
5	„ 30	6th	Levant	St. Just	The Levant Mine Adventurers.	Thomas Grenfell	23	Ditto	Fell into a hole under the tram road in consequence of the plank breaking while he was crossing upon it.	–	–	1	–
6	Feb. 1	4th	Drakewalls	Gunnislake	The Drakewalls Mining Co., Limited.	Henry Rodda	65	Mine Agent.	While crossing an old winze on a plank it gave way, owing to being decayed. He fell some fathoms, receiving a considerable shock.	–	–	1	–

List of Non-fatal Accidents, &c.—*continued.*

No. of Accident.	Date.	Hour of Shift when Accident happened.	Name of Mine.	Where situate.	Owner's or Company's Name.	Persons injured.	Reputed Age.	Occupation.	Remarks.	Persons injured. Falls of Ground.	In Shafts.	Miscellaneous Underground.	Above-ground.
7	1893. Feb. 6	8th	East Pool - -	Illogan - -	The East Pool Mine Adventures.	James Trewhella -	36	Miner -	Leg broken by a loose stone at the side of the ladder which he and his comrade were ascending in a "pass" from the 200 to the 180-fathom level. The stone was disturbed by his comrade, who was in advance of him.	–	–	1	–
8	" 7	4th	Phœnix United -	Linkinhorne Liskeard	The Phœnix United Mining Co	Richard Carlyon -	51	Ditto - (tributer).	His comrade, in climbing up on the back of the lode to a "tribute pitch," disturbed a stone, which rolled down and struck his leg, breaking it.	1	–	–	–
9	" 13	6th	South Wheal Frances	Illogan - -	The South Wheal Frances United Adventurers.	Nicholas Combellack	20	Miner -	Having stumbled over a tram-rail, he put his hand out to save himself, but, striking against the feot-wall, broke his arm.	–	–	1	–
10	" 15	3rd	Kingsteignton -	Kingsteignton -	Messrs. Watts, Blake, Bearne, & Co.	James Phillips -	40	Ditto -	When moving a ladder in the shaft of one of the clay mines he disturbed an iron clamp, which had some days before been taken off the pump and laid carelessly on one of the shaft timbers. In falling the clamp struck and injured him.	–	1	–	–
11	" 17	6th	Wheal Agar -	Illogan - -	Wheal Agar Adventurers.	John Mitchell -	21	Stoper -	While pinching out some stones in a stope, a piece fell and slid against his leg and broke it.	–	–	1	–
12	" 27	1st	Wheal Basset -	Ditto -	Wheal Basset Adventurers.	John Martin - -	23	Miner -	Pulling down a stone after blasting, it rolled against his foot.	1	–	–	–

List of Non-fatal Accidents, &c.—*continued.*

No. of Accident.	Date.	Hour of Shift when Accident happened.	Name of Mine.	Where situate.	Owner's or Company's Name.	Persons injured.	Reputed Age.	Occupation.	Remarks.	Persons injured. Falls of Ground.	In Shafts.	Miscellaneous Underground.	Above-ground.
13	1893. Mar. 4	5th	Monk's Park -	Corsham -	The Bath Stone Firms, Limited.	James Merrett -	31	Miner -	Having sawn a stone through, one part fell over and crushed his foot.	–	–	1	–
14	„ 17	6th	South Wheal Frances	Redruth - -	The South Wheal Frances United Adventurers.	Samuel Dower -	49	Shaftman	While engaged repairing the pit-work, a piece of timber appears to have fallen from some unknown point in the shaft and broke his arm.	–	1	–	–
15	„ 21	3rd	Botallack - -	St. Just - -	The Botallack Mine Adventurers.	Richard Boyns -	23	Filler -	Fingers crushed by the door of a waggon which he allowed to slip when raising it.	–	–	1	–
16	„ 29	3rd	Wheal Agar - -	Illogan - -	The Wheal Agar Adventurers.	John Morcome -	31	Miner (tributer).	While engaged in a "tribute-pitch," getting down some ground, a piece of ore came away unexpectedly and injured him.	1	–	–	–
17	„ 31	5th	Furzey Ground -	Wareham -	Pike Brothers -	Phillip Stickland -	35	Miner -	A three-cornered lump of clay appears to have fallen out from a natural joint, where he was getting timber to take into the workings. It struck and dislocated his thigh.	1	–	–	–
18	Apr. 8	3rd	Phœnix United -	Linkinhorne, Liskeard	The Phœnix United Mines Co.	Phillip Cook - George Parry - - Wm. John Martin -	49 22 20	Ditto - Ditto - Ditto -	Fall of ground (soft granite) from the back of the stope in which they worked.	3	–	–	–
19	„ 14	5th	East Pool - -	Illogan - -	The East Pool Mine Adventurers.	Richard Scoble -	20	Trammer	A stone about 5 lbs. weight fell from the hanging wall of a stope, and rebounding fell to the 70 fathom level, where it struck him.	–	–	1	–
20	„ 18	4th	Wheal Crebor -	Tavistock - -	The Wheal Crebor Co.	Joseph Gale - -	24	Shaftman	He was taking a bar of iron (about 12 lbs. weight) down the ladder road, and, missing his hold, fell about 10 feet.	–	1	–	–

List of Non-fatal Accidents, &c.—*continued.*

No. of Accident.	Date.	Hour of Shift when Accident happened.	Name of Mine.	Where situate.	Owner's or Company's Name.	Persons injured.	Reputed Age.	Occupation.	Remarks.	Persons injured. Falls of Ground.	Persons injured. In Shafts.	Persons injured. Miscellaneous Underground.	Persons injured. Above-ground.
21	1893. Apr. 19	5th	Dolcoath	Camborne	The Dolcoath Mine Adventurers.	Thomas Lowry	19	Mining Student.	While in the shaft watching a timberman at work, he was struck in the back by a small stone which fell from the ascending skip.	–	1	–	–
22	„ 27	6th	Corsham Down	Corsham	Yockney & Co.	Frank Lodge	24	Miner	Broken leg by a fall of ground from a pillar at which they were working. Former workings which the men had not discovered caused its release from a joint which was known.	1	–	–	–
23	May 12	1st	Devon Great Consols	Tavistock	The Devon Great Consols, Limited.	Anthony Dartch	65	Ditto	He was crushed while descending by the man-engine, having missed the step upon which he should have descended.	–	1	–	–
24	June 15	4th	Gawton	Ditto	The Gawton Mine Adventurers.	Henry Murphy	14	Assistant trammer	His fingers were crushed by a tram passing over them on the surface, he having stumbled.	–	–	–	1
25	„ 30	2nd	Tincroft	Illogan	The Tincroft Mine Adventurers.	James H. Paull	22	Miner	A stone fell from the side of the shaft and injured his arm while he was engaged at the 150-fathom level erecting a staging.	–	–	–	1
26	July 6	5th	South Frances United	Ditto	The South Wheal Frances United Adventurers.	Stephen Chynowell	20	Carpenter	While engaged helping to erect some surface-dressing machinery, the end of the shafting slipped and struck him on the back.	–	–	–	1
27	„ 6	4th	East Pool	Ditto	The East Pool Mine Adventurers.	Thomas Gribble	22	Miner	While engaged at work in a winze he seems to have slipped or overbalanced and fallen on the mineral, which caused injuries to his head and back.	–	–	1	–

List of Non-fatal Accidents, &c.—*continued.*

No. of Accident.	Date.	Hour of Shift when Accident happened.	Name of Mine.	Where situate.	Owner's or Company's Name.	Persons injured.	Reputed Age.	Occupation.	Remarks.	Persons injured. Falls of Ground.	In Shafts.	Miscellaneous Underground.	Above-ground.
28	1893. Aug. 1	4th	Tincroft - -	Carn-Brea -	The Tincroft Mine Adventurers.	W. J. Trevillian -	26	Miner -	Fall of ground at the 150-fathom level injured his back.	1	–	–	–
29	" 2	7th	East Pool - -	Ditto -	The East Pool Mine Adventurers.	Thomas Morrish -	46	Ditto -	A scale of ground "bursted" out from the breast of the end where he was working, and a sharp piece striking his back, cut it. This kind of burst occurs at times, and is apparently due to the ground being in a state of tension.	1	–	–	–
30	" 2	4th	Wheal Agar - -	Illogan - -	The Wheal Agar Adventurers.	William Thomas -	39	Ditto -	He knocked his elbow against a rock, and at the time thought nothing of it. It, however, after a few days became so painful that he was obliged to remain off work for a time.	–	–	1	–
31	" 5	10th	Tincroft - -	Carn-Brea -	The Tincroft Mine Adventurers.	John Matthews -	24	Timberman	A gig or cage which he was assisting to lift into an upright position on the surface dropped back and injured his collar-bone.	–	–	–	1
32	" 15	3rd	Ditto - -	Ditto -	Ditto - -	John Harris - -	27	Trammer	While engaged with a shovel filling a tram underground, it came in contact with the tram, which forced the end of the handle into his thigh.	–	–	1	–
33	" 18	3rd	Wheal Agar -	Illogan - -	The Wheal Agar Adventurers.	John Thomas -	47	Tributer	While travelling along the 150-fathom level, near the bottom of a "pass," a small stone struck his head and cut it.	1	–	–	–

List of Non-fatal Accidents, &c.—*continued.*

No. of Accident.	Date.	Hour of Shift when Accident happened.	Name of Mine.	Where situate.	Owner's or Company's Name.	Persons injured.	Reputed Age.	Occupation.	Remarks.	Persons injured. Falls of Ground.	Persons injured. In Shafts.	Persons injured. Miscellaneous Underground.	Persons injured. Above-ground.
34	1893. Aug. 18.	3rd	South Frances United	Illogan - -	The South Wheal Frances United Adventurers.	William Treloar -	20	Miner -	He fell about 7 feet, into the "Platt," having apparently slipped when lifting the tram on to the rails.	–	–	1	–
35	Sept. 13	5th	Devon Great Consols	Tavistock -	The Devon Great Consols, Limited.	Frederick Gale -	21	Ditto -	A pile of rocks, forming a "stilling," on which he was standing, gave way, and he fell 2 or 3 fathoms with the rocks, resulting in some bruises, &c.	1	–	–	–
36	" 13	5th	Tincroft - -	Carn Brea -	The Tincroft Mine Adventurers.	Henry Saunders -	47	Ditto -	He and others were engaged on a temporary scaffold in a stope, and while about to change a drill he overbalanced or slipped and fell about 6 fathoms.	–	–	1	–
37	" 15	8th	Botallack - -	St. Just - -	The Botallack Mine Adventurers.	Thomas Grenfell -	17	Ditto -	Not keeping himself within the "gig" or "cage," while ascending the shaft, he was crushed against a beam forming part of the "pent-house" over the landing at the 160-fathom level.	–	1	–	–
38	" 19	3rd	Phœnix United -	Linkinhorne, Liskeard.	The Phœnix United Mining Co.	Josiah Abraham -	19	Ditto -	He was on a plank wheeling ore into a "pass," when it tipped up, causing him to fall a distance of 4 fathoms.	–	–	1	–
39	" 29	7th	Levant - -	St. Just - -	The Levant Mining Co.	James Warren -	23	Trammer	On rounding a corner riding on a tram-load of rubbish, it got off the rails and threw him against the side of the level.	–	–	1	–

List of Non-fatal Accidents, &c.—*continued.*

No. of Accident.	Date.	Hour of Shift when Accident happened.	Name of Mine.	Where situate.	Owner's or Company's Name.	Persons injured.	Reputed Age.	Occupation.	Remarks.	Persons injured. Falls of Ground.	In Shafts.	Miscellaneous Underground.	Above-ground.
40	1893. Oct. 14	3rd	Phœnix United -	Linkinhorne, Liskeard	The Phœnix United Mining Co.	William Hodge -	55	Engineman	He was on a gangway from the shaft, assisting the lander to lift a tram on to the rails, and in some manner over-balanced or slipped and fell 12 feet from it to the level of the dressing floors.	–	–	–	
41	„ 18	6th	South Frances United	Illogan - -	The South Wheal Frances United Adventurers,	George Retallack -	23	Stamps watcher.	Skull slightly fractured by a winch or crane handle, which slipped from his hands while engaged raising a stamp head which was being replaced.	–	–	–	1
42	„ 31	4th	Tincroft - -	Ditto -	The Tincroft Mine Adventurers.	James Richards -	58	Miner -	He was engaged with a pick, which resulted in a splinter of rock striking his eye.	–	–	1	–
43	Nov. 3	9th	Farleigh - -	Monkton Farleigh	The Bath Stone Firms, Limited.	Tom Burden -	–	Ditto -	The crane handle at which he was working slipped from his hands and struck him.	–	–	1	–
44	„ 7	7th	Ditto - -	Ditto -	Ditto -	Albert Ford - -	–	Ditto -	When running a loaded tram by gravitation down the tram road on the surface, his foot slipped from the brake lever, which, flying up, struck his head.	–	–	–	1
45	„ 13	7th	Botallack - -	St. Just -	The Botallack Mine Adventurers.	William H. Addicoat	15	Ditto -	While engaged shovelling stuff into the tram-hole or "platt" at 150-fathom level, a small stone fell from the hanging wall and fractured his skull. It appears there was a stull about 18 feet up, but I see no reason why the place should not have been kept in a safe condition.	–	–	1	–

List of Non-Fatal Accidents, &c.—*continued.*

No. of Accident.	Date.	Hour of Shift when Accident happened.	Name of Mine.	Where situate.	Owner's or Company's Name.	Persons injured.	Reputed Age.	Occupation.	Remarks.	Persons injured. Falls of Ground.	Persons injured. In Shafts.	Persons injured. Miscellaneous Underground	Persons injured. Above-ground.
46	1893. Nov. 18	6th	Kingsdown -	Farleigh - -	The Bath Stone Firms, Limited.	Joseph Tiley -	39	Quarryman	In jumping to get clear of a detached piece of stone which he was assisting to roll out from its place, he alighted unfortunately, and fractured his leg.	–	–	1	–
47	„ 21	7th	Devon Great Consols	Tavistock -	The Devon Great Consols, Limited.	Henry Burridge -	19	Miner -	His arm was caught in a cog-wheel on the dressing floors and broken; he went to grease these wheels without rhyme or reason, as it is alleged not to have been his work, nor was it required.	–	–	–	1
48	„ 22	7th	South Frances United	Illogan - -	The South Wheal Frances United Adventurers.	Alfred Bartle -	35	Ditto -	He slipped or stumbled and fell against the end of the tram-rail, rupturing himself.	–	–	1	–
49	„ 23	4th	Wheal Grenville -	Camborne -	The Wheal Grenville Mining Co.	Richard Angove -	38	Ditto -	While engaged in Fortescue's shaft he slipped and fell 3 or 4 feet, cutting his head slightly.	–	1	–	–
50	Dec. 1	7th	Botallack - -	St. Just - -	The Botallack Mine Adventurers.	John T. Grenfell -	25	Ditto -	He had filled the skip at the 180-fathom level, and before signalling it away was examining to see that the wheels, &c., were all clear. While so engaged a signal was given at some of the upper levels by someone unknown who wanted to ride to the surface, and in consequence of which the skip was drawn up. He was caught up by it, and carried several feet, when he fell, his hip-joint being dislocated.	–	1	–	–

List of Non-fatal Accidents, &c.—*continued.*

No. of Accident.	Date.	Hour of Shift when Accident happened.	Name of Mine.	Where situate.	Owner's or Company's Name.	Persons injured.	Reputed Age.	Occupation.	Remarks.	Persons injured. Falls of Ground.	In Shafts.	Miscellaneous Underground.	Above-ground.
51	1893. Dec. 7	9th	South Frances United	Illogan - -	The South Wheal Frances United Adventurers.	Nicholas Hocking -	44	Stamp Watcher.	While engaged coupling up for work some stamps which had been idle, he got his hand crushed between the driving pin and the stamps driver.	–	–	–	1
52	„ 15	2nd	Devon Great Consols	Tavistock -	The Devon Great Consols, Limited.	William Rendle -	38	Miner -	Had two fingers broken while moving a piece of timber in the 103 fathom level.	–	–	1	–
53	„ 28	1st	East Pool - -	Carn-Brea -	The East Pool Mine Adventurers.	James Northey -	55	Ditto -	A piece of timber, supposed to be a wedge belonging to the shaft fittings, fell in the shaft and struck his head while engaged working at the pumps.	–	1	–	–
54	„ 29	8th	Devon Great Consols	Tavistock -	The Devon Great Consols, Limited.	William Strike -	63	Ditto -	He strained himself by lifting a rock in his working place.	–	–	1	–
									Total persons injured - -	12	14	23	9
									Total separate accidents -	10	12	23	9

Fatal Accidents not comprised.

The following fatalities which occurred in or about the mines, but which are not comprised under the Act, were brought under my notice, and I consequently mention them as usual :—

Samuel Partridge, nine years of age, a schoolboy, on the 4th May, on his way from school got on to the sweep rod attached to the crank of the water wheel used for pumping at the Brimley Mine, belonging to the Molland Mining Company, in order to have a ride, but the crank being too near loading pillar, he was crushed to death.

George Marcom, surface labourer, committed suicide on the 17th May by drowning himself in the Cook's Kitchen Mine Engine Pond. It was alleged that it was due to injuries which he received at his work, but this does not seem to have been proved.

Mary Dale, eight years of age, a school child, on the 2nd of October in play ran up on the top of the arsenic flue, where it crosses the road in the Botallack Mine. She was passing the place with some of the girls employed on the dressing floors who, however, left her behind, thinking she was amusing herself, and thought nothing further about her until she was inquired for late at night. She was subsequently found dead inside the flue, the top having apparently given way under her weight and allowed her to fall through.

Reports of Assisting Inspectors.

85, Pembroke Road, Clifton, Bristol,
March 10, 1894.

SIR,

In pursuance of section 20 of the Metalliferous Mines Regulation Act, 1872, I have the honour to report to you that during the past year I have exercised the duties of an Inspector of Mines in the South-Western District, and that in so doing I have acted as assistant to and under the direction of the Inspector in charge of that district.

I am,
Sir,
Your obedient Servant,
R. DONALD BAIN.

The Right Hon. the Secretary of State,
Home Office, Whitehall, London.

8, Clifton Villas, Truro,
March 10, 1894.

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I am,
Sir,
Your obedient Servant,
E. E. V. STOKES.

The Right Hon. the Secretary of State,
Home Office, Whitehall, London.

REPORT

OF

HENRY HALL, Esq., H.M. INSPECTOR OF MINES

FOR THE

LIVERPOOL DISTRICT (No. 7),

TO

HER MAJESTY'S SECRETARY OF STATE,

UNDER

The Coal Mines Regulation Act, 1887, the Metalliferous Mines Regulation Acts, 1872 and 1875, and the Slate Mines (Gunpowder) Act, 1882;

For the Year 1893.

Presented to both Houses of Parliament by Command of Her Majesty.

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1894.

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Mr. Hall's Report.

REPORT on the INSPECTION of MINES in the WEST LANCASHIRE and NORTH WALES INSPECTION DISTRICT, from the 31st December 1891 to the 31st December 1893.—By HENRY HALL, Esq.

SIR, Rainhill, 26 March 1894.

As Inspector Mines for the Liverpool District, comprising West Lancashire and North Wales, I have the honour to submit a Report for the year ending the 31st December 1893.

The loss of life in and about the mines of this inspection district amounted to 75 persons, being 18 fewer than in the previous year. This total loss of life is not so favourable as last year when the stoppage of work for 16 weeks or thereabouts is taken into consideration, but it is considerably better than the average since 1873. (*See* diagram on page 4.) The causes of accident have as usual been very various, but falls of roof and coal account for nearly 55 per cent. of the death roll.

Two hundred and forty-six separate accidents have been reported to me during the year, resulting in the deaths of 75 persons and injuries more or less serious to 184 others. Of these accidents 52 fatal and 123 non-fatal occured in the West Lancashire division and 20 fatal and 51 non-fatal in North Wales; the loss of life from these accidents being 54 in the former division and in the latter 21, or a total of 75 persons. In addition to these accidents there has been a large number of slight injuries, entailing loss of work and wages to the individuals, but not of such a serious nature as to require notice of them to be given under the Act of Parliament. The Lancashire Miners Permanent Relief Society report 6,477 cases of disablement among something like 53,000 members for the year 1893, of whom 4,867 claimed for more than one week. In many cases of accident it is somewhat difficult to decide whether the injury should be classed as a "serious personal injury" and reported to the inspector, and consequently the practice of different managers in this respect varies considerably. The inspectors as a body have had this matter under consideration, and the feeling appears to be, that if the injury is likely to disable the workman for seven days it should be reported in accordance with the Act of Parliament, as a "serious personal injury"; if this suggestion is adopted, then some thousands, in place of hundreds of accidents will be reported to the inspectors. I am glad to be able to report that the district has escaped any serious explosion of firedamp, only one death during the year being attributed to this cause, by an explosion in a sinking pit at the Lea Green Colliery near St. Helens, where candles were being used on a bricking scaffold some 300 yards deep, and which at the time was fixed a short distance above a coal seam which had been sunk through and in which firedamp had been found, as no means had been taken to ventilate the space below the scaffold, proceedings were instituted against the owners and manager, but the magistrates held that the ventilation had been attended to so far as was reasonably practicable, and there was no conviction. Precisely similar accidents entailing loss of life have occurred again and again in sinking pits, and in several cases those responsible have been heavily fined. To put an almost close scaffold in a pit making gas below the position of such scaffold, and to introduce no means of carrying the ventilation below by pipes or otherwise, and then to place workmen on the scaffold each with a lighted candle, is the direct way to cause an explosion. The fatalities from falls of roof and coal have, when the strike is taken into account, been more numerous than in any year since 1873. This class of accident cannot be materially diminished until systematic timbering in the working places is made compulsory by law; when that is done, I believe a great improvement will immediately follow. The new rule should be something as follows: "Every certificated manager of a mine "shall specify the maximum distance that props or supports may be fixed in every "coal seam under his charge"; the reasons for this change have been set forth again and again in previous reports, and I am glad to say are at last attracting attention; several juries sitting to inquire into these deaths from falls of roof have expressed the opinion that such a change is urgent.

The quantity of mineral raised during the year 1893 amounted to 10,595,745 statute tons, a decrease of 4,351,166 tons as compared with 1892. This decrease was due to the strike, which lasted 16 weeks or thereabouts, and had there been no strike the production would not apparently have exceeded that of 1892. This total quantity of mineral was made up of 10,511,755 tons of coal, 82,236 tons of fireclay, and 1,754 tons of shale. Of the coal raised West Lancashire contributed 8,305,440 tons, or 3,606,677 tons less than 1892, Denbighshire 1,384,889 tons, and Flintshire 821,426, showing for the latter two counties a decrease of 753,846 tons of coal, the other minerals, clay and shale showing an increase of 9,357 tons. The demand for the months previous to the strike was only limited, many of the collieries not being able to secure sufficient orders to keep their hands regularly employed, but since that time the demand has been urgent and at higher prices.

The aggregate quantity of mineral raised in the United Kingdom during 1893 under the Coal Mines Regulation Act amounted to 175,236,857 statute tons, of which 164,325,795 was coal and 6,560,189 tons of ironstone, the rest being fireclay, oil shale, &c., showing a total decrease of minerals as compared with 1892 of 16,718,051 tons; the decrease in coal amounted to 17,461,076 tons, whilst the other minerals show an increase. This decrease is apparently about what would be due to the 16 weeks stoppage in the districts affected, and this being so, it would appear as if the production of the kingdom generally in the absence of a strike would not have shown any material increase over that of 1892.

The number of persons employed in and about the collieries in this district during the past year has been 57,024, as against 55,215 in the previous year, an increase of 1,809. West Lancashire employed 44,375; Denbighshire, 8,821, and Flintshire, 3,828 persons, West Lancashire raising 230 tons for each person employed underground and the two latter counties together 220 tons for each person employed underground; this output per man is not of much value this year in consequence of the strike, which caused a considerable loss of output, whilst the number of hands on the books of the collieries remained about the same as in previous years. Of the persons employed 46,444 were engaged underground and 10,580 on the surface; of these 3,894 were boys between 12 and 16 years of age, and there were 1,829 women and girls employed on the surface, of whom 207 were between 13 and 16 years of age.

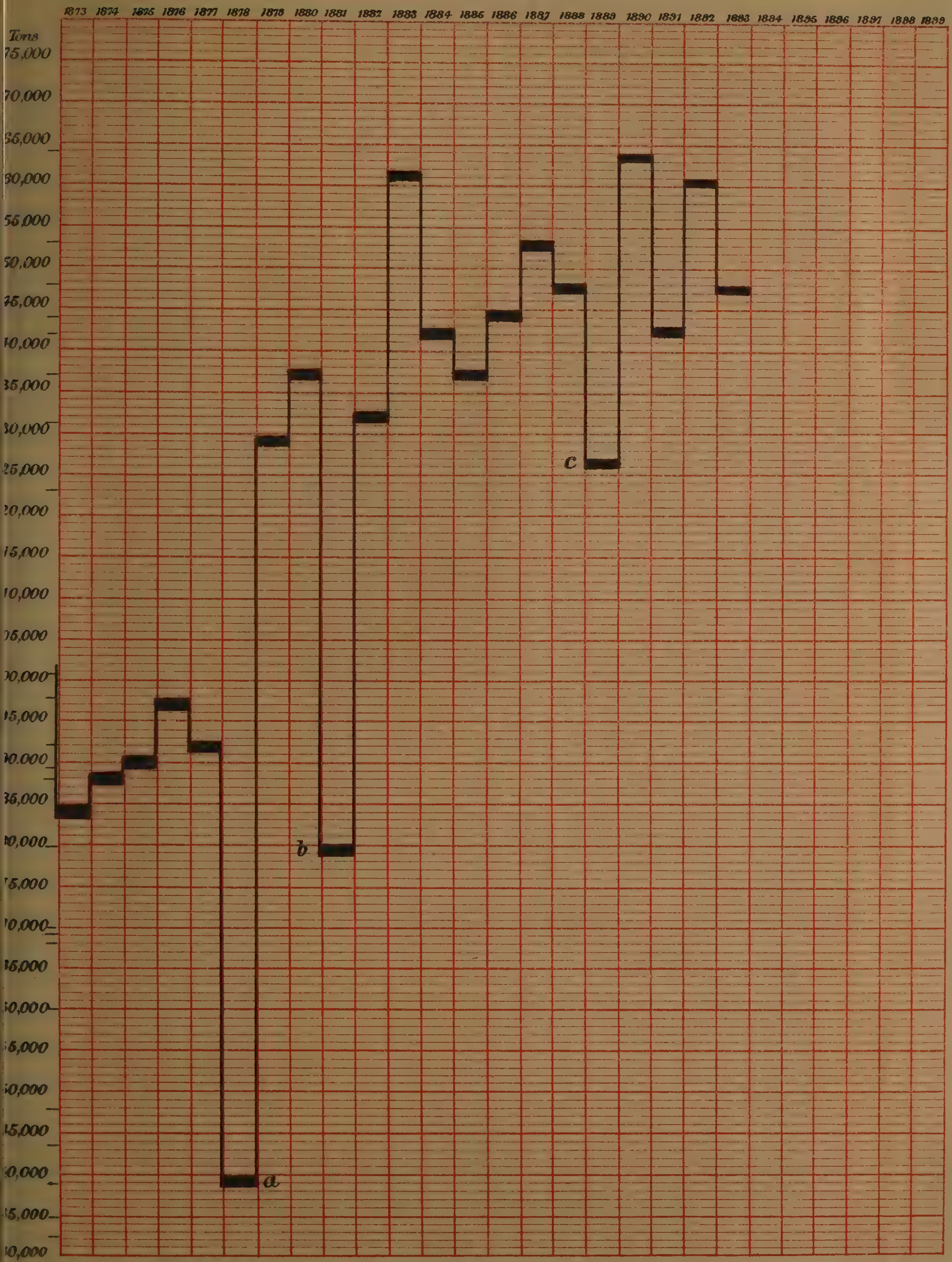
The total number of persons employed in and about mines throughout the United Kingdom under the Coal Mines Regulation Act in the year 1893 was 683,008, as against 683,642 in 1892, showing a decrease of 634, of whom 4,727 were females employed above-ground. These aggregate figures for the two years include about 20,000 persons employed on branch railways and tramways and in washing and coking coal, which in previous years have not been included in these statistics. The hands employed underground for the two years are very similar, being for 1892, 549,312, and for 1893, 549,738 persons.

Wages are the same as last year, and are considered high, but previous to the strike the pits did not work full time, and a week's earnings would be only moderate. Since the strike full time has been worked, and the attendance of the men has been much more regular than is usually the case, due, no doubt, to the wish to get money to enable them to pay off debts incurred during the stoppage.

The coal trade during the first half of the year was very slack and prices very low, more especially where the coal was sold or contracted for in large quantities. The difference between the prices charged to large consumers such as railway companies, gas works, chemical syndicates, and similar undertakings, and those charged for local sales, often amounts to as much as two or three shillings a ton, which appears to be an unfair state of things. Either the former pay too little or the latter pay too much. Probably the former being powerful monopolists, they are able to buy almost at their own price, and we hear it frequently stated that had these large consumers been a little more magnanimous the necessity for a reduction of wages and the consequent strike and injury to their own industries might have been avoided. The average price at the pits has been about 7*s.* 3*d.* per ton in West Lancashire and something like 6*s.* 10*d.* in North Wales. These figures are not obtained from any accurate return of prices, such returns not being required by Act of Parliament, and they must be accepted only as approximate to the truth; possibly they may be a little wide of the mark this year, as during and after the long stoppage prices varied widely and rapidly. At the time of writing the demand seems again to be falling away, and some of the mines are working short time.

The disastrous strike or lock-out, which ever may be its correct description, lasted 16 weeks, and had the usual accompaniments of terrorism and wretchedness, which may as

Diagram Showing the Quantity of Mineral Raised per Life Lost in Lancashire and North Wales, from 1873 to 1893 Inclusive.



a. Wood Pit Explosion .... *No. of Killed* 189
b. Abram Explosion .... *Do.* 48
c. Brynmally Explosion .... *Do.* 20

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well be allowed to rest as things of the past, but it is my duty to point out that the employers had no confidence in the authorities to protect them, and chose rather to be coerced than run the risk of having their property destroyed by the rougher element among the strike hands, and the non-unionists among the workmen dared not go to work, however much they might wish to do so. The local police authorities were apparently more afraid of what is termed "public opinion" than of any actual collision with the strikers. However, this conflict must have clearly taught one lesson to its astute leaders, and that is that it is impolitic and useless to bring to a standstill the whole or any large proportion of the coal mines of the country, as the enhanced price of the commodity quickly repays to the employers the cost of the stoppage, and the shaft which was directed against them misses its mark, but strikes the shooter and the innocent onlooker.

The following tabular statement shows the proportion of separate fatal accidents and lives lost to the number of persons employed and to the quantity of minerals raised, and also the death rate from accident per 1,000 persons employed, for this year and for each previous year since the passing of the Coal Mines Regulation Act, 1872:—

—	Persons employed in and about the Mines.	Tons of Mineral wrought.					Accidents.		Persons employed.		Mineral raised in Statute Tons.		Number of Mines.	Death Rate from Accidents per 1,000 persons employed.
		Coal.	Fire-clay.	Iron-stone.	Shale.	Total.	Separate fatal.	Lives lost.	Per separate fatal accident.	Per Life lost.	Per separate fatal accident.	Per Life lost.		
West Lancashire	44,375	8,305,440	8,989	—	—	8,314,429	52	54	853	821	159,892	153,970	172	
North Wales	12,649	2,206,315	73,247	—	1,754	2,281,316	20	21	632	602	114,065	108,634	67	
Totals and averages, 1893.	57,024	10,511,755	82,236	—	1,754	10,595,745	72	75	792	760	147,163	141,276	239	1·315
Do. 1892	55,215	14,872,278	72,669	92	1,872	14,946,911	73	93	756	593	204,752	160,719	238	1·682
Do. 1891	53,587	15,039,214	75,628	—	1,904	15,116,756	99	106	541	505	152,694	142,610	240	1·978
Do. 1890	50,796	14,491,191	67,437	474	3,438	14,562,540	88	89	577	570	165,483	163,624	236	1·751
Do. 1889	45,655	14,338,145	57,050	231	2,204	14,397,630	89	114	513	400	161,771	126,295	225	2·496
Do. 1888	44,262	13,835,867	60,376	651	2,308	13,899,202	86	94	515	471	161,618	147,863	211	2·123
Do. 1887	43,667	13,693,321	67,143	2,713	14	13,763,191	83	90	526	485	165,821	152,924	211	2·061
Do. 1886	42,245	13,419,989	49,137	2,866	124	13,472,116	94	94	449	449	143,320	143,320	220	2·225
Do. 1885	41,565	13,176,944	59,047	259	2,098	13,240,683	96	97	433	428	137,923	136,502	225	2·333
Do. 1884	41,905	12,799,199	42,115	4,470	11,227	12,857,011	89	91	471	460	144,461	141,286	238	2·171
Do. 1883	41,720	13,304,307	34,979	6,230	8,546	13,354,062	82	83	509	502	162,854	160,892	236	1·989
Do. 1882	40,495	12,452,413	45,165	15,514	9,073	12,522,165	93	95	435	426	134,646	131,812	240	2·345
Do. 1881	39,630	11,843,685	55,589	23,569	10,727	11,933,570	101	151	392	262	118,154	79,030	242	3·810
Do. 1880	39,454	12,029,751	54,433	35,746	11,183	12,131,113	78	89	506	443	155,527	136,304	242	2·256
Do. 1879	39,458	11,783,724	47,711	28,414	15,961	11,875,810	87	97	453	407	136,503	122,431	242	2·458
Do. 1878	39,024	11,651,797	88,454	19,574	9,741	11,769,566	102	304	382	128	115,388	38,716	263	7·790
Do. 1877	40,342	11,426,745	70,334	23,811	957	11,521,847	84	127	480	318	137,165	90,723	301	3·148
Do. 1876	42,174	11,509,339	54,171	22,204	1,900	11,587,614	115	121	366	348	100,762	95,765	312	2·869
Do. 1875	45,136	11,398,032	40,430	20,151	2,352	11,460,965	111	129	407	349	103,252	88,845	313	2·858
Do. 1874	43,658	9,875,762	71,951	29,169	—	9,976,882	95	115	460	380	105,020	86,755	305	2·634
Do. 1873	42,300	10,288,583	41,121	46,896	—	10,376,600	101	125	418	338	102,738	83,012	278	2·955

An examination of this table shows that the year with which the report deals has been unfavourable as regards fatal accidents, the quantity of mineral raised per life lost being 141,276 tons, as against 160,719 last year, whilst the average for the kingdom

is 168,148 tons per life lost. The hours of the "shift" in which accidents have been most numerous in this district are the 5th, 6th, 2nd, and 3rd, whilst for the kingdom the most fatal hours have been the 6th, 3rd, 1st, and 2nd.

The following statement shows the various kinds of accidents, and the number of deaths caused thereby, during each year since the passing of the Coal Mines Regulation Act, 1872:—

		Falls in Mine.			In Shafts.									Miscellaneous Underground.									On Surface.				
	Explosions.	Falls of Side.	Falls of Roof.	Total Falls in Mine.	Overwinding.	Ropes and Chains breaking.	Whilst ascending or descending by Machinery.	Falling into Shaft from surface.	Things falling from surface.	Falling from part way down.	Things falling from part way down.	Miscellaneous in Shafts.	Total in Shafts.	Explosions of Gunpowder, &c.	Suffocation by Gases.	Irruptions of Water.	Falling into Water.	On Inclined Planes.	By Trams and Tubs.	By Machinery underground.	Sundries underground.	Total Miscellaneous underground.	By Machinery on surface.	Boilers bursting.	Miscellaneous on surface, including Railway Sidings.	Total on surface.	Gross Total.
West Lancashire -	1	1	24	25	—	—	—	—	—	2	3	2	7	—	1	—	—	4	3	1	2	11	—	—	10	10	54
North Wales - -	—	3	13	16	—	—	—	—	—	—	—	—	—	—	—	—	—	1	2	—	—	3	—	—	2	2	21
Total in 1893 - -	1	4	37	41	—	—	—	—	—	2	3	2	7	—	1	—	—	5	5	1	2	14	—	—	12	12	75
Do. 1892 - -	—	9	31	40	—	—	4	1	—	—	1	—	6	—	19	1	—	6	9	—	4	39		1	5	8	93
Do. 1891 - -	2	9	51	60	—	—	5	—	2	3	1	2	13	3	1	—	—	5	8	—	3	20	1	—	10	11	106
Do. 1890 - -	1	12	43	55	—	—	2	—	1	2	1	—	6	1	1	—	—	5	6	—	3	16	—	—	11	11	89
Do. 1889 - -	22	6	49	55	—	—	2	2	—	1	1	1	7	—	3	—	—	6	9	—	5	23	1	—	6	7	114
Do. 1888 - -	1	10	42	52	—	—	—	1	1	11	1	1	15	2	—	—	—	4	8	—	6	20	—	—	6	6	94
Do. 1887 - -	6	9	47	56	2	—	—	1	—	5	1	—	9	1	—	—	—	5	4	1	—	11	—	—	8	8	90
Do. 1886 - -	1	10	43	53	—	—	2	1	—	2	—	—	5	1	—	—	—	8	7	—	4	20	—	—	15	15	94
Do. 1885 - -	4	10	47	57	—	—	2	—	—	1	—	1	6	—	—	—	—	3	10	1	4	18	1	—	11	12	97
Do. 1884 - -	4	10	50	60	1	—	—	—	—	1	—	—	2	2	2	—	—	6	3	—	—	13	3	—	9	12	91
Do. 1883 - -	3	8	42	50	—	—	1	—	1	2	—	2	6	—	—	—	—	7	6	1	2	16	—	—	8	8	83
Do. 1882 - -	3	10	26	36	—	—	2	—	—	4	3	3	12	1	—	1	—	8	17	—	4	31	1	—	12	13	95
Do. 1881 - -	55	11	47	58	—	—	3	1	—	2	—	3	9	—	1	—	—	4	7	2	3	17	—	—	12	12	151
Do. 1880 - -	10	5	38	43	—	—	4	1	—	1	1	3	10	—	—	—	—	6	7	—	4	17	—	—	9	9	89
Do. 1879 - -	5	11	36	47	7	—	4	1	1	2	—	—	15	1	2	—	—	5	7	1	—	16	—	—	14	14	97
Do. 1878 - -	204	11	43	54	—	1	2	2	—	4	—	—	9	2	1	—	1	4	9	1	4	22	2	1	12	15	304
Do. 1877 - -	40	8	39	47	3	—	1	3	—	6	3	1	17	1	—	—	—	3	5	—	2	11	4	—	8	12	127
Do. 1876 - -	14	17	44	61	—	1	4	1	2	4	3	3	18	4	—	—	—	5	4	—	3	16	3	—	9	12	121
Do. 1875 - -	6	19	43	62	2	—	8	2	—	5	6	6	29	—	1	—	—	1	8	3	1	14	2	—	16	18	129
Do. 1874 - -	23	3	38	41	3	1	1	3	—	6	2	5	21	2	4	1	—	2	5	—	2	16	1	1	12	14	115
Do. 1873 - -	31	10	32	42	—	1	2	2	—	10	5	2	22	6	—	—	1	8	3	1	2	21	—	—	9	9	125

Thus we see that there is only one death to record under the head of firedamp explosions, a most satisfactory record; indeed, by referring to the list of firedamp explosions, given on pages 14 and 15, it will be seen that there has been a remarkable diminution of this kind of accident during the last 10 years, which is undoubtedly due to the more general use of safety lamps, and the time has arrived when the Legislature should forbid open lights to be used in any coal mine after firedamp has been discovered.

Falls of roof and coal have killed 41 persons; this year this class of accident has been more frequent and fatal than usual, and I have already commented upon it. A large number of these "falls" take place because sufficient timber supports are not fixed up, and where one more prop or one one more bar would have kept all safe, the excuse for

their absence always is "we did not think it unsafe," "we could not see the 'slips,'" "yes, one or two more props would have prevented the 'fall,'" and so forth. I dare say this judgment was quite honest, but how can judgment be applied to invisible dangers from what are termed "slips," that is, fractures in the strata hidden from view, these dangers can only be met by assuming they are always present and putting up supports to the roof systematically.

A large number of accidents happen among the railway waggons, under the screens, and on the sidings, often through what appears to be extraordinary thoughtlessness on the part of the sufferers themselves, but sometimes showing equal thoughtlessness on the part of those who ought to control the operations. A frequent source of accident arises where footpaths cross the railway lines, through the waggons being separated by a few feet only to allow a passage, which forms nothing less than a trap, because if the waggons happen to be bumped when any one is passing through, there is no chance of escape. Either a bridge should be provided or the waggons should always be so placed to allow an opening of several yards in width.

A complete list of the 72 separate fatal accidents for the year is appended to this report, together with a summary of the circumstances under which each accident happened, and also the hour of the "shift" in which each occurred.

In view of new legislation affecting coal mines, I beg respectfully to draw attention to certain regulations in the existing Act of Parliament which appear to call for amendment.

The requirement as to a manager (section 20) (*c*) only applies to mines employing more than 30 persons underground (it is not clear whether 30 underground *at one time*, or 30 within the 24 hours is intended to regulate this requirement), thus smaller mines seem to be left without any manager responsible under the Act, unless the owner is required by an inspector to appoint one. Now that two classes of certificates are provided for, it would be better that every mine should be required to be under a manager, but those employing less than 30 persons underground within 24 hours should have the option of employing a second class certificated man.

The power of the first class certificated manager to delegate the daily supervision of the mine to an undermanager has not worked satisfactorily, as it has had the effect of causing the mines to be left too much in the hands of second class men. The responsibility of owners of mines, and also that of agents, should be made more real, because, as a rule, the control of all important matters affecting the safety or otherwise of the mine is in their hands, and is exercised by them. The "Employers Liability Bill" will, no doubt, have an influence in this direction, and whether this Bill is passed with or without the Contracting-out Clause, it must have a very favourable effect as regards the safety of all mining operations. From an inspector's point of view the Bill would no doubt be more beneficial without any Contracting-out Clause, but, personally, I think this is a question entirely for the decision of the workpeople, for whose benefit it is intended, and, as the employers would have to pay under either arrangement, it cannot be a matter of great importance to them. Any step which has the effect of giving greater publicity to the circumstances and causes of mining accidents will make those accidents less frequent, because employers, as a rule, are very desirous to take precautions when the necessity for such is prominently and convincingly brought under their notice.

The three departments of mining which call most urgently for attention are timbering, blasting, and lighting. To these three have to be debited the great bulk of colliery fatalities in the past, and this will continue to be the case unless some decided steps are taken. I have had the honour frequently to report to you as to the dangers of blasting with gunpowder, and to suggest its total prohibition. The time has now arrived when this course might be adopted without any risk of injury to the coal industry, as several explosives now in the market have proved themselves equal, or even superior, to gunpowder for mining, whilst by their use the dangers incident to blasting almost entirely disappear. These safer explosives have been adopted already by the best firms in Lancashire, Durham, and elsewhere, and compulsion is only needed to compel the laggards to adopt them likewise.

The question of timbering, which is responsible for over 50 per cent. of mine accidents, is also urgent. The statistics referring to this class of fatality do not exhibit the constantly improving ratio since the commencement of mining inspection which is so apparent with regard to most other kinds of accident. With a view to diminish the risks from falls of roofs in the mines, what is called "systematic timbering" has been prominently brought under the notice of the employers, and has been adopted to some extent, and I feel convinced the compulsory enforcement of systematic timbering would

effect a great saving of life. A rule with this object in view has already been submitted to you by the mine inspectors at their annual meeting.

The method of lighting the mines has received little attention in the legislation of the last 20 years, although it is one eminently capable of great improvement. It is still to a great extent optional whether candles or safety lamps shall be used; to enforce the use of safety lamps on an unwilling employer means a long and costly arbitration, and even that still more deadly arrangement of mixed lights has only been partially dealt with. All the best mining authorities made up their minds on this subject many years ago, and whenever this is the case legislation should quickly follow. It is extraordinary how otherwise conscientious managers can allow candles or mixed lights to continue to be used in mines liable to firedamp—thus, as it were, courting disaster. With the view of bringing the subject of lamps more prominently forward and showing its importance, I submit the following statistics of deaths from firedamp explosions, and their causes, during the last 20 years. The collection of these figures has involved the examination of the whole of the mining reports for the kingdom during that period. It is sometimes said that statistics can be made to prove almost anything, but so far as the figures in the column headed "Candles and mixed lights" are concerned, I am satisfied of their absolute correctness. The figures in the columns headed "Blasting with gunpowder" and "Defective lamps or flame passing gauze" may be open to some correction in consequence of the reports dealing with the circumstances of individual accidents leaving the origin of the explosion in some doubt, but any excess in numbers in the one column would only be transposed to the other. Of all the causes to which the explosions are attributed, that of flame passing the gauze of a safety lamp has the least positive evidence to support it.

DEATHS caused by EXPLOSIONS of FIREDAMP and IGNITIONS of GUNPOWDER from 1873 to 1892 inclusive.

Inspection District.	1873.						1874.						1875.						1876.						1877.						Remarks.
	Candles or Mixed Lights.	Blasting with Gunpowder.	Defective Lamps or Flame passing Gauze.	Ignited at Furnace.	Accidental Ignitions of Gunpowder.	Cause not stated.	Candles or Mixed Lights.	Blasting with Gunpowder.	Defective Lamps or Flame passing Gauze.	Ignited at Furnace.	Accidental Ignitions of Gunpowder.	Cause not stated.	Candles or Mixed Lights.	Blasting with Gunpowder.	Defective Lamps or Flame passing Gauze.	Ignited by Furnace.	Accidental Ignitions of Gunpowder.	Cause not stated.	Candles or Mixed Lights.	Blasting with Gunpowder.	Defective Lamps or Flame passing Gauze.	Ignited at Furnace.	Accidental Ignition s of Gunpowder.	Cause not stated.	Candles or Mixed Lights.	Blasting with Gunpowder.	Defective Lamp or Flame passing Gauze.	Ignited at Furnace.	Accidental Ignitions of Gunpowder.	Cause not stated.	
Newcastle	—	—	—	—	5	—	—	—	—	—	5	—	4	—	—	—	3	—	2	—	—	1	1	—	—	1	—	—	1	—	
Durham	1	—	—	—	1	—	1	—	—	—	3	1	1	—	—	—	3	—	4	1	—	—	1	1	2	—	—	—	3	—	
Manchester	1	—	1	—	1	—	6	—	—	—	1	—	2	—	1	—	3	—	5	—	—	—	—	—	33	9	—	—	3	—	
Liverpool	10	19	—	2	6	—	8	15	—	—	2	—	2	3	1	—	—	—	9	4	1	—	4	—	3	37	—	—	1	—	
Yorkshire	5	1	—	4	—	2	28	—	1	—	—	—	18	143	—	1	4	—	3	—	—	—	—	—	1	—	2	—	—	—	
Midland	2	—	1	—	—	1	3	—	—	—	2	—	1	—	—	—	2	—	6	—	—	—	2	—	1	—	—	—	1	1	
N. Stafford	—	20	—	—	1	5	78	—	—	—	4	—	—	43	1	—	—	2	—	11	—	—	—	—	2	—	—	—	2	—	
S. Stafford	2	—	—	—	6	2	2	—	—	—	4	—	7	—	—	—	2	—	4	—	—	—	—	1	11	—	—	—	1	—	
South-western	6	—	—	—	3	1	—	—	—	—	6	1	2	26	—	—	—	4	29	—	—	—	2	—	2	—	—	—	—	—	
S. Wales	7	—	—	—	1	4	6	5	—	—	3	—	18	—	2	—	2	—	2	—	1	—	—	1	22	—	1	—	2	—	
E. Scotland	—	—	—	—	1	—	7	—	—	—	—	—	1	1	—	—	—	—	2	—	—	—	—	—	5	207*	—	—	—	—	* Not conclusive.
W. Scotland	3	—	—	—	5	—	3	—	—	—	1	—	5	—	—	—	1	—	7	—	—	—	2	—	5	—	—	—	—	—	
	1878.						1879.						1880.						1881.						1882.						
Newcastle	1	—	—	—	1	—	1	—	—	—	3	—	1	—	—	—	—	—	—	—	—	—	1	—	2	—	4	—	—	—	
Durham	2	2	—	—	1	—	—	—	—	—	—	—	—	164	—	—	4	—	—	—	—	—	3	—	53	74*	—	—	—	—	* Not conclusive.
Manchester	45	—	—	—	—	—	10	—	—	—	1	—	2	—	—	—	1	—	2	—	—	—	1	—	2	—	—	—	1	—	
Liverpool	2	—	195*	—	2	—	5	—	—	—	1	—	1	9	—	—	—	—	1	4	48*	—	—	—	1	—	—	—	1	2	* Not conclusive.
Yorkshire	2	2	—	—	1	—	31	—	—	—	2	—	43	4	—	—	—	—	1	—	—	—	1	—	1	7	—	—	—	—	
Midland	—	—	—	—	1	—	1	—	—	—	2	—	—	—	—	—	1	—	1	—	—	—	2	3	47	—	—	—	2	23*	* Underground fire.
N. Stafford	2	26	—	—	—	—	9	1	—	—	—	—	2	62	—	—	1	1	8	—	—	4	1	25*	2	—	—	—	2	—	* Underground fire.
S. Stafford	—	2	—	—	2	—	10	—	—	—	1	—	3	1	—	—	1	1	5	1	—	—	1	—	1	—	—	—	2	—	
South-western	—	—	268*	—	1	—	6	—	—	3	1	—	6	120*	—	—	—	—	—	—	—	—	—	—	7	4	—	—	—	—	* Not conclusive.
S. Wales	4	3	—	—	—	—	—	—	—	—	1	63	7	101	—	—	1	—	3	—	—	—	3	—	4	—	—	—	2	6*	* Underground fire.
E. Scotland	2	—	—	—	—	—	4	28	—	—	—	—	1	—	—	—	3	—	2	—	—	—	2	—	11	—	—	—	1	—	
W. Scotland	19	3	—	—	2	—	3	2	—	—	1	—	6	—	—	—	2	—	5	—	—	—	2	—	1	—	—	—	—	—	

DEATHS caused by EXPLOSIONS of FIREDAMP and IGNITIONS of GUNPOWDER from 1873 to 1892 inclusive—*continued.*

Inspection District.	1883.						1884.						1885.						1886.						1887.						Remarks.
	Candles or Mixed Lights.	Blasting with Gunpowder.	Defective Lamps or Flame passing Gauze.	Ignited at Furnace.	Accidental Ignitions of Gunpowder.	Cause not stated.	Candles or Mixed Lights.	Blasting with Gunpowder.	Defective Lamps or Flame passing Gauze.	Ignited at Furnace.	Accidental Ignitions of Gunpowder.	Cause not stated.	Candles or Mixed Lights.	Blasting with Gunpowder.	Defective Lamps or Flame passing Gauze.	Ignited at Furnace.	Accidental Ignitions of Gunpowder.	Cause not stated.	Candles or Mixed Lights.	Blasting with Gunpowder.	Defective Lamps or Flame passing Gauze.	Ignited at Furnace.	Accidental Ignitions of Gunpowder.	Cause not stated.	Candles or Mixed Lights.	Blasting with Gunpowder.	Defective Lamps or Flame passing Gauze.	Ignited at Furnace.	Accidental Ignitions of Gunpowder.	Cause not stated.	
Newcastle	2	—	—	—	3	—	—	—	—	—	—	—	—	42	—	—	—	—	—	—	—	—	1	—	4	8	—	—	2	—	
Durham	—	—	—	—	7	—	—	—	—	—	3	—	—	—	—	—	1	—	—	28*	—	—	2	—	—	—	—	—	1	—	* Not conclusive.
Manchester	6	—	68	—	3	—	—	—	—	—	—	—	180	—	—	—	1	—	1	—	38	—	1	—	—	—	—	—	1	—	
Liverpool	1	2	—	—	—	—	2	—	2	—	2	—	1	3	—	—	—	—	1	—	—	—	1	—	—	6	—	—	1	—	
Yorkshire	—	—	20	—	1	—	1	—	—	—	—	—	1	—	1	—	1	—	1	22	—	—	—	—	—	—	—	—	2	—	
Midland	2	—	—	—	5	—	1	—	—	—	1	—	—	—	—	—	1	—	2	—	—	—	—	—	1	—	—	—	1	—	
N. Stafford	—	—	—	3	2	6*	2	3	—	—	1	—	1	8	—	—	—	9	—	—	—	—	—	—	1	—	3	—	4	—	* Gob fire.
S. Stafford	2	—	—	—	5	—	16	—	—	—	2	—	2	—	—	—	2	—	2	—	—	—	—	—	3	—	—	—	3	—	
South-western	9	—	—	—	—	—	2	—	—	—	1	14	3	—	—	—	1	—	19	—	3	—	1	—	1	—	—	—	—	—	
S. Wales	4	—	—	—	2	5	5	14	2	—	3	—	2	—	—	—	—	10	7	—	—	—	—	4	1	39	—	—	3	—	
E. Scotland	1	—	—	—	4	—	3	—	—	—	6	—	1	—	—	—	—	—	—	1	—	—	2	—	7	74	—	—	4	—	
W. Scotland	3	—	—	—	1	—	3	—	—	—	1	—	3	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	
	1888.						1889.						1890.						1891.						1892.						
Newcastle	1	30	—	—	—	—	—	6	—	—	3	1	—	—	—	—	5	—	5	—	—	—	2	—	1	1	—	—	2	—	
Durham	—	—	—	—	3	—	—	—	—	—	3	—	—	—	—	—	3	—	—	—	—	—	2	—	—	—	—	—	3	—	
Manchester	—	—	—	—	—	—	—	—	—	—	1	—	2	—	—	—	—	—	—	2	—	—	2	—	—	—	—	—	3	—	
Liverpool	1	—	—	—	2	—	2	—	20	—	—	—	1	—	—	—	1	—	—	2	—	—	3	—	—	—	—	—	—	—	
Yorkshire	2	—	2	—	1	—	2	—	—	—	—	—	2	—	—	—	1	—	2	—	—	—	4	—	—	—	1	—	—	—	
Midland	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	1	—	—	—	—	—	1	—	—	—	—	—	1	—	
N. Stafford	—	—	—	—	—	—	26	—	—	—	1	64*	—	2	—	—	3	—	1	10	—	—	1	—	—	—	—	—	1	—	* Possibly gob fire.
S. Stafford	2	—	—	—	2	—	4	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	2	—	2	—	—	—	—	—	
South-western	—	—	—	—	1	—	5	—	—	—	1	—	182	—	—	—	3	—	14	—	—	—	—	—	—	—	—	—	—	1	
S. Wales	7	—	—	2	2	—	2	—	—	—	3	—	4	87	—	—	6	—	9	—	—	—	1	—	1	—	112	—	4	—	
E. Scotland	1	—	—	—	3	1	1	—	—	—	3	—	5	—	—	—	3	—	2	—	1	—	2	—	2	—	—	—	2	—	
W. Scotland	1	—	—	—	1	—	4	1	—	—	6	—	5	—	—	—	3	—	1	—	—	—	5	—	1	1	—	—	7	—	

SUMMARY TABLE of DEATHS from EXPLOSIONS of FIREDAMP and their CAUSES, also of DEATHS from ACCIDENTAL IGNITIONS of GUNPOWDER in MINES from 1873 to 1892, both inclusive.

Inspection Districts.	Candles or Mixed Lights.	Blasting with Gunpowder.	Defective Lamps or Flame passing Gauge.	Ignited at Furnace.	Cause not stated.	Accidental Ignitions of Gunpowder.	Total Deaths.
Newcastle - -	24	88	4	1	1	38	156
Durham - -	64	269	—	—	2	47	382
Manchester -	297	11	108	—	—	24	440
Liverpool - -	51	104	267	2	2	27	453
Yorkshire - -	144	179	27	5	2	18	375
Midland - -	68	—	1	—	28	27	124
North Stafford -	134	186	4	7	112	24	467
South Stafford -	78	4	—	—	4	37	123
South-western -	293	150	271	3	21	21	759
South Wales - -	115	249	118	2	93	39	616
East Scotland -	58	311	1	—	1	36	407
West Scotland -	79	7	—	—	—	40	126
	1,405	1,558	801	20	266	378	4,428

The totals under the various headings in the summary table speak for themselves, and their significance cannot be increased by any words of mine. The aggregate total under the heading of candles or mixed lights shows a loss of 1,405 lives, a result simply appalling when we remember that a remedy has been all the time within easy reach.

The second column in the same table shows the lives lost through blasting with gunpowder and to these must be added those due to accidental ignitions of gunpowder shown in the sixth column; these latter are accidents in the *handling* of gunpowder charges, and they are most frequent in mines worked with open lights. We thus have a total of deaths due to gunpowder amounting to 1936. It would not, perhaps, be quite true to say of this class of accident that a remedy has always been at hand, but that is so now by means of the high explosives such as roburite, ammonite, &c., and whether notwithstanding, gunpowder will continue to be used for the next 20 years, as has been the case with candles, depends upon the character and effectiveness of legislation.

I had the honour to make a further special report on the influence of coal dust in colliery explosions, and submitted the following conclusions as the result of a great number of practical experiments with different coal dusts from all parts of the kingdom.

The phenomena presented by these experiments as they progressed, and a careful examination of the detailed results warrant the following conclusions:—

(1.) That the flame from a blowing-out gunpowder shot in the presence of dry coal dust *always* ignited more or less of such dust, and so increases the burning and charring effects of the shot. This is proved by the fact that in almost every experiment which did not result in an actual explosion of dust, there was, nevertheless, severe charring of the electric firing cable for several yards up the shaft, whilst without dust and with a similar charge of explosive no such charring occurred.

(2.) That when a large flame, such as that of a blowing-out gunpowder shot or the flame from the ignition of a small quantity of firedamp, traverses an atmosphere containing a very moderate quantity of dry coal dust, the dusty atmosphere will explode with great violence, and the explosion will *continue on* and pass throughout any length of such atmosphere, its violence and force increasing as it progresses. This is proved by the fact that in nearly every case where the cannon was fired whilst there was dust suspended in the atmosphere of the shaft, a violent explosion followed, the force of which was evidently only beginning to be developed as it reached the top of the shaft and escaped, spending itself in the outside air, the flame in some cases attaining a height of 70 feet over the top of the shaft. It is true there are exceptions to this rule, as in the case of the samples received from the Forest of Dean, Somerset, South Stafford (Great Fenton and West Cannock), Moston, Lancashire, and South Wales Anthracite. The difference in the results from these dusts was I think due to some difference in the character of the coal seams in those districts. There were also partial failures with the samples from Auckland Park and Trimdon Grange (Durham), and from Talk-o'-th'-Hill, Astley and Tyldesly, and Llanerch, but in these latter cases I am satisfied that a little more perseverance with the tests and a more careful collection of the samples would have resulted in explosions.*

* In the Haydock experiments reported in 1890, the dust explosions travelled 200 yards, and were evidently increasing in force and violence as they reached the top of the shaft.

(3.) That coal dust from several seams in different districts, notably those from Glamorgan, Monmouth, Durham, Lancashire, Yorkshire, and Scotland, are almost as sensitive to explosion as gunpowder itself. (*See* details of experiments where violent explosions were produced with the dust at rest in the shaft.)

(4.) That coal dust is as a rule more sensitive to explosion in proportion to its high quality and freedom from impurities.

(5.) That a ready supply of oxygen such as is supplied by a brisk ventilation has the effect of making coal dust explosions more probable and more severe.

(6.) That certain "high explosives" are incapable of igniting or exploding coal dust. It will be noticed in the details of experiments that charges of roburite, and, in two or three cases ammonite, were fired without effect, but as soon as gunpowder was introduced its explosion was followed by violent dust explosions. The difference in the behaviour of gunpowder as compared with the "high explosives" *was most impressing and convincing.*

Of the whole of the dusts tested, that from the Albion Colliery, Glamorgan (Aberdare or Merthyr four-feet seam or upper four-feet) excelled all others in violence and sensitiveness to explosion, and this seam in the South Wales district has the worst history of any in the kingdom, upwards of 1,600 persons having been killed in it by explosions since the year 1845. Indeed, throughout the experiments, one could not fail to be struck by the great violence and sensitiveness to explosion exhibited by the samples received from collieries with an unfortunate history as regards explosions.

It was, I think, also evident from the experiments that the higher the quality of the coal seam the more liability there is to explosions of dust, and it is singular that the collected history of explosions in mines in past years shows that nearly all sweeping disastrous explosions have happened in seams producing the highest class of coal, such as the Durham Hutton Seam, Yorkshire, Barnsley and Silkstone Seams, the Lancashire Arley Seam, and the South Wales Aberdare four-feet and Black Veins.

With regard to precationary measures to be taken in the face of these facts, I have again to urge the total abolition of gunpowder from coal mines and the substitution of certain "high explosives." Many of the largest firms in the country have already of their own motion taken this step.

Mines which are naturally of a dry and dusty character cannot be artificially damped so as to render gunpowder safe, but it is nevertheless imperative, in the absence of gunpowder, that every possible effort should be made, either by watering or removing, to avoid accumulations of dry dust, so that any accidental ignition of firedamp may be limited in its effects and prevented from developing into a sweeping explosion through the agency of dust.

The most important and weightiest evidence in confirmation of the fact of the explosiveness of coal dust is, I think, contained in the following letter from a deputation of upwards of 70 managers and undermanagers of mines who witnessed some of the experiments at White Moss Colliery :—

National Association of Colliery Managers, Lancashire Branch.

Orrell Colliery, Wigan,
August 10th, 1883.

Sir,

At a special meeting of the colliery managers of the above branch the following resolution was proposed by Mr. Halliwell, of Dewsbury Park Colliery, and seconded by Mr. Walls, of Hindley Field Colliery, and carried unanimously :—

"That the best thanks of the Lancashire colliery managers be tendered to Mr. Hall, Her Majesty's Inspector of Mines, for his kindness in inviting them to witness his experiments with coal dust at White Moss."

As secretary of the branch I was also instructed to say that every colliery manager who saw the experiments is now firmly convinced that it is dangerous to use gunpowder in a dry and dusty mine, and that it ought not to be allowed to be taken into such mines. They are further of opinion that no colliery manager would continue to use it if he once witnessed your experiments.

Yours respectfully,
On behalf of the colliery managers,
(Signed) P. Mehers,
Hon. Sec.

To Henry Hall, Esq.,
H.M. Inspector of Mines.

This letter emanated from 70 hard-headed men familiar with every aspect of mining, and whom it would be eminently difficult to convince in the absence of absolute

practical proof. Personally, I felt that the evidence of these gentlemen, as conveyed in their letter, was final and conclusive, and that it must necessarily outweigh all negative evidence founded on mere expression of opinion.

The work of the year has consisted in keeping conversant with the general condition of the whole of the mines in the district by means of inspections and visits from time to time in the absence of any complaint or accident. Many of the mines appear to require much more energy and intelligence in the management than is provided, others leave almost nothing to be desired in this respect. "Wide work" or "long wall" is now the system most usually adopted, and where it is carried out with skill it is a great improvement on the "bord and pillar," but if the "packing" or stowing with debris of the vacant spaces is neglected, then there is endless expense and increased danger. Two hundred and forty-six accidents have been reported, and have had the attention of either the assisting inspector or myself; the sites of all serious or fatal accidents have been inspected, and the circumstances carefully inquired into. These circumstances vary considerably, but in many accidents they repeat themselves again and again; this is more especially the case with regard to falls of roof, and the lessons they teach are very difficult to apply where every workman is allowed to be almost his own judge in the matter of supports for the roof of his working place. All complaints, anonymous and otherwise, have received careful attention, and in many cases by means of these communications attention has been drawn to serious dangers. The assisting inspector has made 160 undergroung inspections, I have been underground on 92 separate days, and between us we have attended about 70 inquests. We have been fully occupied with inspections, inquests, inquiries, reports, and correspondence, and have done our best to enforce the law, and to treat both employer and workmen with courtesy and fairness.

In addition to the duties of coal mine inspector, I have acted as inspector under the Metalliferous Mines Act, Mr. Matthews also acting as an inspector under both Acts.

I have, &c.,
HENRY HALL,
Her Majesty's Inspector of Mines.

The Right Hon. H. H. Asquith, Q.C., M.P.,
Her Majesty's Principal Secretary of State,
Whitehall.

LIST of FATAL EXPLOSIONS, with the NUMBER OF DEATHS caused thereby, in MR. HALL'S DISTRICT from 1873 to 1893 inclusive.

Name of Colliery.	Where situate.	No. of Deaths.	Cause of Explosion.
WEST LANCASHIRE.			
1873.			
Mesnes Colliery - -	Wigan - -	7	Open lights.
Brynn Hall ,, - - -	Ditto - -	6	Gunpowder.
Ravenhead ,, - -	St. Helens - -	1	Open lights.
Ashton's Green ,, - -	Ditto - -	1	Ditto.
1874.			
Ince Hall Colliery - -	Wigan - -	15	Gunpowder.
Norley ,, - -	Ditto - -	4	Open lights.
Downall Green ,, - -	Ditto - -	1	Ditto.
Peasley Cross ,, - -	St. Helens - -	1	Man opened his safety lamp.
1875.			
Bradley Hall Colliery - -	Wigan - -	1	Open lights.
1876.			
Orrell Colliery - -	Ditto - -	2	Gunpowder.
Prospect ,, - - -	Ditto - -	1	Fired at Davy lamp.
Moss ,, - -	Ditto - -	1	Gunpowder.
Brynn Hill ,, - -	Ditto - -	1	Ditto.
Edge Green ,, - -	Golborne - -	1	Opening safety lamp.
Moss ,, - - -	Skelmersdale -	1	Open lights.
Barley Brook ,, - -	Wigan - -	1	Ditto.
Swan Lane ,, - - -	Ditto - -	1	Gunpowder.
1877.			
Pemberton Colliery - - -	Ditto - -	36	Ditto.
Bradley Hall ,, - -	Ditto - -	1	Open lights.
1878.			
Wood Colliery - -	Haydock - -	189	Fired at Davy lamp (supposed).
Whiston ,, - - - -	Prescot - -	7	Spontaneous combustion.
1879.			
Garswood Hall Colliery - -	Wigan - -	3	Open lights.
1880.			
——	—	—	No fatal explosions.
1881.			
Abram Colliery - -	Wigan - -	48	Fired at Davy lamp (supposed)
Park Lane ,, - - -	Ditto - -	2	Gunpowder.
Tawd Vale ,, - -	Skelmersdale -	1	Ditto.
Tawd Vale ,, - - -	Ditto - -	1	Ditto.
Sutton Heath ,, - - -	St. Helens -	1	Open lights.
1882.			
Phœnix Colliery - - -	Ditto - -	1	Open lights.
1883.			
Mains Colliery - - - -	Wigan - -	2	Gunpowder.
1884.			
White Moss Colliery - -	Skelmersdale -	1	Open lights.
1885.			
Strangeways Hall Colliery - -	Wigan - -	2	Gunpowder.
Sutton Heath ,, - -	St. Helens -	1	Open lights.
Taylor Pit - - - -	Wigan - -	1	Gunpowder.
1886.			
Bradley Hall Colliery - -	Ditto - -	1	Open lights.
1887.			
Lilly Lane Colliery - - -	Ditto - -	3	Gunpowder.
1888.			
Lea Green Colliery - -	St. Helens - -	2	Open lights.
1889.			
——	—	—	No fatal explosions.
1890.			
Ravenhead Colliery - -	Ditto - -	1	Open lights.
1891.			
Moss Hall Colliery - -	Wigan - -	2	Open light from ignition of fuse whilst lighting a shot.
1892.			
——	—	—	No fatal explosions.
1893.			
Lea Green Colliery - - -	St. Helens -	1	Open lights on scaffold in sinking pit.
21 years - - - -	Total deaths -	353	West Lancashire.

LIST OF FATAL EXPLOSIONS—*continued.*

Name of Colliery.	Where situate.	No. of Deaths.	Cause of Explosion.
NORTH WALES.			
1873.			
Wynnstay Colliery - - -	Ruabon - -	7	Gunpowder.
Hafod " - - -	Ditto - -	5	Chargeman opened his safety lamp.
Vauxhall " - - -	Ditto - -	2	Furnace.
Gwersyllt " - - -	Wrexham - -	1	Open lights.
Hanmer " - - - -	Mostyn - -	1	Gunpowder.
1874.			
Vron Colliery - - -	Wrexham - -	2	Open lights.
1875.			
Hafod Colliery - - -	Ruabon - -	3	Gunpowder.
Bryn-yr-owen " - -	Ditto - -	1	Open lights.
Bersham " - - -	Wrexham - -	1	Fired at Davy lamp.
1876.			
Westminster Colliery - - -	Ditto - -	3	Open lights.
Wrexham " - -	Ditto - -	1	Opening safety lamp.
Buckley " - -	Mold - -	1	Open lights.
South Buckley " - -	Ditto - -	1	Ditto.
1877.			
Brynmally Colliery - - -	Wrexham - -	3	Ditto.
1878.			
Pendwll Colliery - - -	Ditto - -	6	Not known.
Brymbo " - - - -	Ditto - -	1	Open lights.
Broughton " - - -	Ditto - -	1	Ditto.
1879.			
Ffrwd Colliery - - -	Ditto - -	2	Open lights.
1880.			
Bersham Colliery - - -	Ditto - -	9	Gunpowder.
Wrexham " - - -	Ditto - -	1	Open lights.
1881.			
Llay Hall Colliery - - -	Ditto - -	2	Furnace.
1882.			
Maes-y-greg Colliery - - -	Mold - -	2	Fired at Davy lamp,
1883.			
Sandycroft Colliery - - -	Ditto - -	1	Open lights.
1884.			
Bettisfield Colliery - - -	Bagillt - -	2	Defective safety lamp.
Mostyn " - - -	Mostyn - -	1	Open lights.
1885.	—	—	No fatal explosions.
1886.	—	—	No fatal explosions.
1887.			
Ffrwd Colliery - - -	Wrexham - -	3	Gunpowder.
1888.	—	—	No fatal explosions.
1889.			
Brynmally Colliery (Pendwll pit) -	—	20	Safety lamps improperly open.
1890.	—	—	No fatal explosions.
1891.	—	—	No fatal explosions.
1892	—	—	No fatal explosions.
1893.	—	—	No fatal explosions.
21 years - - - -	Total deaths -	83	North Wales.

COAL MINES REGULATION ACT, 1887.

BOARD FOR EXAMINATIONS FOR THE MINING DISTRICT OF WEST LANCASHIRE AND NORTH WALES.

QUESTIONS for the EXAMINATION of CANDIDATES for FIRST CLASS CERTIFICATES of COMPETENCY, June 1893.

INSTRUCTIONS TO CANDIDATES.

1. During the Examination the Candidate must not speak to any other Candidate or hold any communication with him, nor must he leave the room until he has completed his paper, nor then without the permission of the Secretary.
2. Answers must be written on the paper supplied. Each sheet must be signed at the foot with the name of the Candidate. The Candidate is not required to answer all the questions, but he must show a competent knowledge in each subject. Answers must be written on one side of the paper only.
3. All papers handed to the Candidate must be returned, and no Candidate is allowed to take away with him a copy of the questions, or of any of them.

Preliminary.

State your name, age, and address.

Elementary Education and Ventilation.

1. What is the weight of water in a range of pipes, 7 inches diameter and 120 yards vertical height?
   State the pressure at the bottom of stocks.
2. In a mine ventilated by a fan the quantity of air produced is 150,000 cubic feet per minute, with 2·5 inches water gauge. If the speed of the fan be increased by one-third, what will be the effect on the volume of the air, and on the water gauge? Show calculation.
3. State the laws relating to the friction of air in mines?
4. What is the weight of coal in an estate of 22½ statute acres, the coal being 3 feet 6 inches thick and its specific gravity 1·3?
5. On the accompanying plan of a fiery mine mark the ventilation and the furnace and dumb drift.

Principles of Mechanics and Machinery.

6. Given a feeder of water of 30 gallons a minute to be conveyed, in close pipes, along an undulating road, 500 yards long, the head of water at the starting point being 2 feet. What size of pipes would be required?
7. What amount of expansion do you expect in a vertical range of steam pipes 150 yards long? How would you provide for such expansion.
8. Explain the difference between an ordinary safety valve and "Cowburn" or "Hopkinson's" valve. Compare their respective merits.
9. What weight would you hang on each of eight conducting rods, in a shaft 500 yards deep, where the rods are each 1½ inches diameter? Describe and give sketches of the requisite arrangements at the top of the headgear and in the sump hole.

10. Compare the relative advantages and disadvantages of electricity and compressed air when used as a motive power in a mine.

11. Sketch the best form of capping for winding ropes:
    (a.) Flat ropes;
    (b.) Round ropes (ordinary and locked coil).

12. How would you prepare for a thorough inspection a large Lancashire boiler, and to what points would you more especially direct your attention in making such inspection?

Mine Working.

13. State in detail the requirements of the Mines Regulation Act, with regard to shot firing in a dry and dusty mine in which inflammable gas has recently been seen.

14. Give a sketch of the way you would build in a pair of air doors between the intake and return airways of a mine, with dimensions.

15. What is the duty of a manager with regard to:
    (a.) Ventilation;
    (b.) Notices;
    (c.) Discipline.

16. To keep back a feeder of water met with in a tunnel, 7 feet × 5 feet, 150 yards from the surface, what sort of dam would you put in? Give sketch, and describe how you would proceed with the work.

17. What precautions would you take to guard against underground fires in engine-houses? Suggest arrangements which you would provide to minimise the danger which may result from an unforeseen fire in an underground engine-house.

18. If you have 200 tons of coal a day to haul up a road 1,000 yards long, with an inclination of 1 in 15, where the tubs are put on at three different stations, describe what system you would adopt, and what regulations you would enforce.

19. Describe and sketch, with dimensions, a boiler-house and flues suitable for a boiler 28 feet by 7 feet, to be placed in a mine 500 yards deep and 30 yards distant from the upcast shaft.

Timbering.

20. What are the requirements of the Mines Regulation Act as to the provision of timber, and with regard to the duty of a collier as to its use?

21. What is your opinion as to the use of iron and steel in place of timber in the laying out and working of coal mines?

22. When and where do you consider the use of timber "chocks" or "packs" advisable in a mine worked under the long wall system?
    Describe how you would set them, and the method you would adopt to withdraw them.

Surveying.

23. How do you check the accuracy of "Sight lines" in driving a main road, where the roof is liable to give way?

24. Define the conditions under which you would make "Theodolite" and "Magnetic" surveys respectively, and describe the modes of plotting.

25. What are "Bench marks," "Contour lines," and "Intermediate sights"?

Shafts.

26. What special precautions would you ensure being carried out in the signalling arrangements when sinking a shaft?

27. Describe and give sketches of water and bricking rings, and the lining of sinking pits? How far apart would you have the supporting rings? Give reasons.

28. A shaft 16 feet in diameter and 400 yards deep, fitted with wire-rope guides and two cages, is used for winding coal in the day time. It has to be sunk in the night time 100 yards deeper. Describe how you would do this and what precautions you would observe.

Questions for the Examination of Candidates for Second Class Certificates of Competency, June 1893.

Instructions to Candidates.

1. During the Examination the Candidate must not speak to any other Candidate or hold any communication with him, nor must he leave the room until he has completed his paper, nor then without the permission of the Secretary.
2. Answers must be written on the paper supplied. Each sheet must be signed at the foot with the name of the Candidate. The Candidate is not required to answer all the questions, but he must show a competent knowledge in each subject. Answers must be written on one side of the paper only.
3. All papers handed to the Candidate must be returned, and no Candidate is allowed to take away with him a copy of the questions, or of any of them.

Preliminary.

State your name, age, and address.

1. A parallel drum for a round rope is 16 feet diameter and makes 30 revolutions each winding. What is the depth of the pit?
2. What is the quantity of air passing in cubic feet per minute through an air-pipe 1 foot 6 inches diameter, when the velocity is 20 feet per second.
3. What are the duties of an undermanager as regards:
   (*a.*) Employment of men and boys;
   (*b.*) Safety lamps;
   (*c.*) Timber.
4. What sort of explosive do you prefer in a gassy mine, and how would you use it?
5. Do you prefer brattice or air-pipes for directing the ventilation when driving a tunnel? Give reasons for your reply.
6. What are the requirements of the Coal Mines Regulation Act, as to the keeping of books and plans.
7. Describe the method of using an anemometer and a water gauge, and give an example of the information you would obtain by the use of these instruments.
8. Give a sketch of an overcast air crossing, with sizes, that you consider suitable to put over the main road in an extensive mine.
9. A shot intended to be fired by electricity has missed fire. What should be done?

MINES CLASSED UNDER THE COAL MINES REGULATION ACT.

LIST of the FATAL ACCIDENTS, and DEATHS arising therefrom, within one Year and a Day from the date of the Accident, during the Year 1893.

No. of Accidents.	Date and Hour of the Accident.	Hour of the Person's Shift, i.e., No. of Hours he had been at Work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above-ground.	Total.
						WEST LANCASHIRE.									
1	1892. Dec. 28 2 p.m.	9th	Ravenhead -	St. Helens -	St. Helen's Collieries Co., Limited -	John Marsh -	28	Collier -	Inquest attended. The deceased was working in a ribbing; he had his bars within 30 inches of the face, when some roof coal fell between the bar and face. He succumbed to the injuries received on Jan. 23, 1893.	–	1	–	–	–	1
2	Dec. 29 9.30 p.m.	2nd	Mains - -	Wigan - -	Cross, Tetley, & Co., Limited - -	Joseph Littler -	55	Timber-drawer	Inquiry made, and inquest attended. The deceased was drawing props, and whilst drawing one the roof fell upon him. He did not use the gablock and chain. He succumbed to the injuries received Jan. 16 1893.	–	1	–	–	–	1
3	1893. Jan. 4 10.30a.m.	4th	Bickershaw -	Leigh -	Ackers, Whitley, & Co., Limited.	Alexander Lawson	21	Screenman	Inspection and inquiry made. The waggon lowerer left some waggons near the crossing and lowered some more, which bumped against the others, and drove them suddenly down, crushing the deceased between the buffers.	–	–	–	–	1	1

List of Fatal Accidents—*continued.*

No. of Accidents.	Date and Hour of the Accident	Hour of the Person's Shift, i.e., No. of Hours he had been at Work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Firedamp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above-ground.	Total.
4	1893. Jan. 9 8.30 p.m.	6th	Bold - -	Collins Green -	Collins Green Colliery Co., Limited.	Edward Parry -	18	Packer -	Inspection made and inquest attended. Whilst building a pack along with his father, a stone fell from between two slips upon the deceased; they must have disturbed the roof by drawing props out.	–	1	–	–	–	1
5	Jan. 11 4 p.m.	2nd	Park Lane -	Wigan - -	Garswood Coal and Iron Co., Limited -	Thomas Flaherty -	33	Sinker -	Inspection made and inquest attended. The deceased was struck on the head by a brick falling down the shaft, most probably from where there was some unfinished walling at the ingate of the shaft at the surface.	–	–	1	–	–	1
6	Jan. 25 5 p.m.	2nd	Collins Green -	Earlstown -	Collins Green Colliery Co., Limited -	John Wimbs -	45	Daywageman	Inspection made. The deceased, with other contractors, were taking some side off a haulage road, when some of the roof fell upon him. They had drawn some props previously, and plucked what was loose in the roof, without replacing props.	–	1	–	–	–	1
7	Feb. 2 1.30 a.m.	7th	Prescot - -	Prescot - -	Wigan and Whiston Coal Co., Limited.	Joseph Thomas -	14	Assistant packer.	Inspection made. He was assisting his father to pack, when the roof fell out from a slip upon him. They had been getting out a prop, which must have disturbed the roof.	–	1	–	–	–	1

List of Fatal Accidents—*continued.*

No. of Accidents.	Date and Hour of the Accident.	Hour of the Person's Shift, i.e., No. of Hours he had been at Work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Firedamp.	Lives lost. Falls of Roof and Sides.	Lives lost. In Shafts.	Lives lost. Miscellaneous Underground.	Lives lost. Above-ground.	Lives lost. Total.
8	1893. Feb. 6 9 a.m.	3rd	Orrel - -	Wigan - -	Orrel Coal & Cannel Co., Limited -	William Leigh -	51	Collier -	Inquiry made and inquest attended. The deceased was working under the top coal, when a portion of same fell, capping a prop, causing a flesh wound; blood poisoning eventually set in. He died on the 25th instant.	–	1	–	–	–	1
9	Feb. 15 8.15 a.m.	3rd	Pewfall - -	Ashton - -	Richard Evans & Co., Limited - -	Henry Lyne -	15	Pony driver	Inspection made and inquest attended. The deceased was driving a pony, and was apparently getting on the journey to ride, and fell over, the front tub passing over him.	–	–	–	1	–	1
10	Feb. 17 10 p.m.	5th	Billinge Lane -	Wigan -	Winstanley Collieries Co., Limited -	Thomas Lavin -	23	Dataler -	Inspection made and inquest attended. The deceased was a contractor's man, and while preparing to drill a hole in a stone, which they had failed to bar down from the roof, it gave way to a slip, falling upon him.	–	1	–	–	–	1
11	Feb. 21 2.30 p.m.	9th	Worsley Mesnes	Wigan - -	Worsley Mesnes Colliery Co. -	Isaac Thomas -	28	Metalman -	Inspection made and inquest attended. While driving an exploring level, to prove through some disturbed ground, a fall occurred from between two steps crossing the road, which they had neglected to timber. The officials should have instructed that the place should have been propped during their last examination.	–	1	–	–	–	1

List of Fatal Accidents—*continued.*

No. of Accidents.	Date and Hour of the Accident.	Hour of the Person's Shift, i.e., No. of Hours he had been at Work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost.					
										Explosions of Firedamp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above-ground.	Total
12	1893. Mar. 1 3 p.m.	9th	Amberswood -	Wigan -	Hindley Brick and Coal Co. -	Joseph Lever -	50	Screenman	Inquiry made. Deceased was repairing a bolt in the slack hopper, and stepped into a truck unknown to the driver of the horses attached thereto; the truck being suddenly drawn forward, he was crushed against the hopper.	–	–	–	–	1	1
13	Mar. 1 11.15a.m.	6th	Bamfurlong -	Wigan -	Cross, Tetley, & Co., Limited.	John Sumners -	18	Waggon-lowerer.	Inspection made and inquest attended. The deceased was in the act of stepping under the buffers of two railway waggons, to couple them, when the locomotive was shunting some four other waggons to the same siding. There appeared to have been some carelessness on the brakesman's part, who joined the waggons up without giving warning.	–	–	–	–	1	1
14	Mar. 8 11.30p.m.	3rd	Low Hall -	Ditto -	Moss Hall Coal Co. -	Patrick Lynch -	30	Packer -	Inspection made and inquest attended. They were roofing down, and had a bridge of about 6 yards to get down, which was 2 feet thick, and whilst drilling a hole at one end of this, nearly the whole length of it suddenly fell, catching the deceased, who was sitting under it. The witnesses in their evidence said 10 props were under, and knocked out by the fall.	–	1	–	–	–	1

List of Fatal Accidents —*continued.*

No. of Accidents.	Date and Hour of the Accident.	Hour of the Person's Shift, i.e., No. of Hours he had been at Work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Firedamp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above-ground.	Total.
15	1893. Mar. 13 8.15 a.m.	3rd	Low Hall -	Wigan -	Moss Hall Coal Co. -	John Medlin -	20	Drawer -	Inspection made and inquest attended. The deceased was bringing down a tub from the face, with one scotch in same, to a point where the dip increased to 4 inches per yard; and before he secured the other scotch, he was overpowered and crushed against a bar, which was only 5 inches higher than the tub. He was in front of tub, contrary to special rules.	–	–	–	1	–	1
16	Mar. 16 1 p.m.	7th	Brynn Hall -	Wigan -	Brynn Hall Colliery Co., Limited.	Edward Fletcher -	43	Collier -	Inspection made and inquest attended. The deceased while bringing his tub down a brow, was overtaken, and crushed by another tub, the scotch having come out and overpowered the other drawer. The road was narrow in the lower part where the accident occurred, and the jury recommended the road to be made wider on one side.	–	–	–	1	–	1
17	Mar. 28 2.30 p.m.	9th	Mains -	Ditto	Cross, Tetley, & Co., Limited.	William Green -	50	Machinery examiner.	Inquiry made. He was examining the brake of the haulage engine, and had taken a bolt out of same, when he instructed the engine-man to bring the journey up, and and remained inside the fencing, (*Continued.*)	–	–	–	1	–	1

List of Fatal Accidents—*continued.*

No. of Accidents.	Date and Hour of the Accident.	Hour of the Person's Shift, i.e., No. of Hours he had been at Work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost: Explosions of Firedamp.	Lives lost: Falls of Roof and Sides.	Lives lost: In Shafts.	Lives lost: Miscellaneous Underground.	Lives lost: Above-ground.	Lives lost: Total.
	1893.		(*Continued.*)						when his clothes got entangled with the rope, and he was crushed with the drum. He succumbed to the injuries received on March 30, 1893.						
18	Apr. 7 11.30a.m.	6th	Tawd Vale -	Skelmersdale -	Tawd Vale Colliery Co., Limited.	Michael Fay -	32	Hooker-on -	Inspection made and inquest attended. They were working the coal back close to the shaft to finish, which caused the brickwork to crush, a piece of brick falling down the shaft fracturing the deceased's skull. A daily examination of shaft to be made instead of weekly.	–	–	1	–	–	1
19	Apr. 11 3.30 p.m.	10th	Broomfield -	Standish -	Wigan Coal & Iron Co., Limited.	John Heyes -	21	Collier -	Inspection made and inquest attended. The deceased was filling a tub near the face when a stone fell upon him from between two slips in the roof capping three props.	–	1	–	–	–	1
20	Apr. 12 1.30 a.m.	4th	Long Lane -	Ashton -	Garswood Coal and Iron Co., Limited.	John Niland -	24	Sinker -	Inspection and inquiry made. A stone fell upon the deceased from a slip on side of shaft, about 5 yards above where they were working, just below the bottom ring. The shaft is said to have been examined about an hour before the accident occurred. Died on the 23rd April 1893.	–	–	1	–	–	1

List of Fatal Accidents—*continued.*

No. of Accidents.	Date and Hour of the Accident.	Hour of the Person's Shift, i.e., No. of Hours he had been at Work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Firedamp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above-ground.	Total.
21	1893. Apr. 13 11.30p.m.	6th	Billinge Lane -	Wigan -	Winstanley Collieries Co., Limited.	Thomas Rothwell -	19	Drawer -	Inspection made and inquest attended. The deceased was drawing along a road 4 yards wide, with only a middle row of props in it, set 4 feet to 9 feet apart, when the roof fell to a slip running parallel with the road. The jury said they considered more timber was necessary; they will bar the roads in future that are this width.	–	1	–	–	–	1
22	Apr. 14 2.30 p.m.	9th	Park - -	Ashton -	J. and R. Stone -	Martin Higgins -	20	Labourer -	Inspection made and inquest attended. Deceased was knocked down by the locomotive whilst carrying a rail over the branches on his shoulder. The locomotive was pushing two waggons backwards up the line, the driver and brakesman both being on the engine at the time, but appear to have failed to see that the line was clear for them.	–	–	–	–	1	1
23	Apr. 24 1.40 p.m.	8th	Brynn -	Ditto -	Richard Evans & Co., Limited.	James Allen - -	59	Carpenter -	Inspection made and inquest attended. The deceased had been doing some repairs in the pit and had come up to the surface, and was in the act of getting some tools out of the cage, when the engineman lowered the cage crushing the deceased. The (*Continued.*)	–	–	1	–	–	1

List of Fatal Accidents—*continued.*

No. of Accidents.	Date and Hour of the Accident.	Hour of the Person's Shift, *i.e.*, No. of Hours he had been at Work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Firedamp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above-ground.	Total.
	1893.		*(Continued.)*						banksman was required to do other work, as well as attend to the signals, and was not on the brow at the time of the accident; which showed great carelessness. The jury were of opinion that if the browman had been on duty on the pit bank the accident would not have occurred.						
14	Apr. 26 10.30a.m.	5th	Eccleston Hall	St. Helens -	Worsley Mesnes Colliery Co.	Thomas Lythgoe -	64	Shotlighter	Inspection made and inquest attended. Deceased was in the act of firing a shot in metal they were roofing down, from under which they had taken two sprags and a prop, when a portion of the roof gave way to a slip, crushing the deceased.	–	1	–	–	–	1
25	April 26 6 a.m.	1st	Billinge Lane -	Wigan - -	Winstanley Colliery Co., Limited.	William Taylor -	27	Drawer -	Inspection made and inquest attended. The deceased was descending the pit in the cage with some other men, when the ascending cage stopped at the 5 feet mine to bring up some night men. The deceased probably thought the cage had reached the bottom of pit, and stepping out, fell a distance of 36 yards, and was killed. In future the cage with men in will be lowered direct to the bottom.	–	1	–	–	–	1

List of Fatal Accidents—*continued.*

No. of Accidents.	Date and Hour of the Accident.	Hour of the Person's Shift, i.e., No. of Hours he had been at Work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Firedamp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above-ground.	Total.
26	1893. April 27 4 p.m.	10th	Pemberton	Wigan	J. Blundell & Sons	Abraham Jones	18	Engineman	Inspection made and inquest attended. A spur wheel of an underground hauling engine broke, and part fell on the steam pipe, breaking it, causing a rush of steam into the engine-house. Deceased, who was driving the engine, was badly scalded. The engine-room was provided with two exits, and the wheel comparatively new. There was no apparent cause for it giving way.	–	–	–	1	–	1
27	May 10 2.30 p.m.	9th	Parr	St. Helens	Richard Evans & Co., Limited.	James Percival	33	Collier	Inspection made and inquest attended. The shaft is 500 yards deep. The cages were fitted with two wire guides only, and the cage appears to have swayed and caught at a bearer, and threw the deceased out, as the cage was ascending. The clearance was 18 inches. The jury recommended strongly three guides to each cage.	–	–	1	–	–	1
28	May 11 10.45a.m.	5th	Golborne	Golborne	Richard Evans & Co., Limited.	Frank Johnson	33	Fireman	Inspection made and inquest attended. The deceased was examining a brow rising 1 in 4, in which there was a blower of gas reported giving off from the Bastiens Coal in the floor, and fenced off. (*Continued.*)	–	–	–	1	–	1

List of Fatal Accidents—*continued.*

No. of Accidents.	Date and Hour of the Accident.	Hour of the Person's Shift, i.e., No. of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost.					
										Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Aboveground.	Total.
	1893.		(*Continued.*)						He was found suffocated behind the brattice, about 4 yards from face, having left his lamp just below him, and probably attempting to repair behind the brattice when he was overcome by the gas.						
29	May 20 10 a.m.	4th	Sherdley -	St. Helens -	Whitecross Co., Limited.	Thomas Molyneaux	49	Collier -	Inspection made and inquest attended. The deceased and three others were working a pillar out next to the goaf, under the top coal and cannel, without setting sufficient timber, when the roof gave way, capping two props, and crushing the deceased.	–	1	–	–	–	1
30	May 17 3 p.m.	10th	Ditto -	Ditto -	Ditto -	Peter Maddock -	35	Collier -	Inquiry made and inquest attended. When attempting to get to the cage, they were crushing against each other, and the deceased, who was carrying his tea-can, had it forced into his ribs, and although no ribs were broken, he died from blood poisoning on the 22nd instant.	–	–	–	1	–	1
31	June 27 6.30 a.m.	1st	Wood - -	Ditto - -	Richard Evans & Co., Limited.	John Critchley -	29	Waggon-lowerer.	Inspected and inquiry made. Deceased was caught between two waggons, which were being lowered by hand; he appeared to have slipped on the railway metal.	–	–	–	–	1	1

List of Fatal Accidents—*continued.*

No. of Accidents.	Date and Hour of the Accident.	Hour of the Person's Shift, i.e., No. of Hours he had been at Work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Firedamp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Under-ground.	Above-ground.	Total.
32	1893. June 2 2 p.m.	8th	Taylor	Standish	Wigan Coal and Iron Co., Limited.	Joseph Kerfoot	30	Pusher-on	Inspection made and inquest attended. The deceased was in the act of drawing a tail-rope down past the endless-rope far-end haulage sheave, with his hand on the haulage-rope, when he was drawn into the sheave and was crushed.	–	–	–	1	–	1
33	June 9 10.30a.m.	5th	Lea Green	St. Helens	Sutton Heath and Lea Green Collieries Co., Limited.	James Roscoe	35	Shunt minder.	Inspection made and inquest attended. The deceased was in the act of sending a journey out of shunt, when a portion of rock which was spragged on side of road fell. The witnesses stated there was no sign of it giving way previous to the accident.	–	1	–	–	–	1
34	July 26 11.45a.m.	6th	Ashtons Green	Ditto	Bromilow, Foster, & Co., Limited.	William Greenough	21	Collier	Inspection made and inquest attended. The deceased was working at the face, when a fall of roof occurred from between two slips; they had neglected to keep their props set near the face.	–	1	–	–	–	1
35	1892. Aug. 2 11.50a.m.	6th	Garswood Hall	Wigan	Garswood Hall Collieries Co., Limited.	John Greenhall	41	Collier	Inspection made. Deceased was working a ribbing in widework, and there were slips over his drawing-road, which he had not sufficiently secured, when the roof fell from between two slips. He succumbed to the injuries on Apri 17th, 1893.	–	1	–	–	–	1

List of Fatal Accidents—*continued*.

No. of Accidents.	Date and Hour of the Accident.	Hour of the Person's Shift, i.e., No. of Hours he had been at Work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Firedamp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above ground.	Total.
36	1892. Aug. 28 11.30a.m.	6th	Abram -	Wigan -	Abram Coal Co., Limited.	James Oakes -	32	Labourer -	Inquiry made and inquest attended. Deceased got crushed between two spring buffers of railway waggons, near the screens, while attempting to pass between them.	–	–	–	1	–	1
37	Sept. 9 11 a.m.	5th	Amberswood -	Ditto -	Moss Coal Co. -	George Berry -	50	Fireman -	Inspection made and inquest attended. While clearing out an old mouthing near the shaft, which had been arched previously, a fall took place, crushing the deceased under the baulks, which had been set to support the arch.	–	1	–	–	–	1
38	Sept. 17 2 p.m.	8th	Tawd Vale -	Skelmersdale -	Tawd Vale Colliery Co., Limited.	David Forshaw -	27	Collier -	Inspection made, and inquest attended. The deceased was working in face of a down-brow, when a stone fell from a pot hole, in the roof; he succumbed to the injuries received December 14th.	–	1	–	–	–	2
39	Oct. 14 4 a.m.	6th	Lea Green -	St. Helens -	Sutton Heath and Lea Green Collieries Co., Limited.	Evan Jones -	38	Sinker -	Inspection made, and inquest attended. While the deceased and seven other men were engaged walling the pit, an explosion of gas took place; the deceased succumbed to the injuries received on the 20th instant.	–	–	–	1	–	1
40	Oct. 24 7.0 a.m.	1st	Elms - -	Wigan -	Wigan Cannel Colliery, Limited.	John Carrick -	32	Labourer -	Inspection made and inquest attended. The deceased was leaning against the fence of the staging, which was insecure at that point. He fell over causing internal injuries and died on the 29th instant.	1	–	–	–	–	1

List of Fatal Accidents—*continued.*

No. of Accidents.	Date and Hour of the Accident.	Hour of the Person's Shift, i.e., No. of Hours he had been at Work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Firedamp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above-ground.	Total.
41	1892. Oct. 24 6.30 a.m.	1st	Mains -	Wigan -	Cross, Tetley, & Co., Limited.	James Knowles -	64	Waggon-greaser.	Inspection and inquiry made. The deceased was an old man greasing waggons. He got between a standing waggon and one that was being lowered from under the screens at about four miles an hour, and was crushed; the person who let the waggon loose did not see the deceased at the time to warn him.	–	–	–	–	1	1
42	Nov. 2 2 p.m.	8th	Long Lane -	Ditto -	Swan Lane Brick and Coal Company.	John Garner -	21	Waggon-man.	Inspection made and inquest attended. The deceased was in an empty waggon when the scotch gave way; he got caught between top of waggon and slack box of screen, there being only a few inches clearance.	–	1	–	–	–	1
43	Nov. 7 9 50 p.m.	3rd	Kirkless -	Ditto -	Kirkless Colliery Co., Limited.	John Hurst - John Westhead -	44 37	Collier - Ditto.	Inspection made and inquest attended. While getting the clod down, the roof fell from between two steps capping a prop. The stone had been examined a short while previously, when it appeared quite safe.	–	2	–	–	–	2
44	Nov. 21 11 a.m.	5th	Park Lane -	Ditto -	Garswood Coal and Iron Co., Limited.	John Wrench -	25	Dataler -	Inspection made and inquest attended. While clearing the haulage road of dirt that had fallen during the strike, a wheel of the hauling engine gave way, causing the tubs to run back, and a chain breaking, two tubs ran down the brow, crushing the deceased before he reached the refuge hole.	–	–	–	1	–	1

List of Fatal Accidents—*continued*.

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45	1892. Nov. 23 11 a.m.	5th	Pumping Shaft Lane Side.	Wigan	Ince Coal and Cannel Co.	James Heyes	46	Manager	Inquiry made. The deceased injured his leg while examining the shaft on June 14th, but was attending to his duties for some months afterwards, when blood poisoning set in; he died on November 23rd.	–	–	1	–	–	1
46	Nov. 17 11.30a.m.	6th	Park	Ashton	J. and R. Stone	Matthew Marsh	52	Loco-driver	Inquiry made. The deceased fainted, and in falling his head came in contact with some steel girders, which were supporting an old locomotive in the engine shed causing injuries to his head that he died the following day.	–	–	–	–	1	1
47	Nov. 23 8.45 a.m.	3rd	Sherdley	St. Helens	Whitecross Co., Limited.	William Brown	40	Collier	Inspection made and inquest attended. The deceased was engaged getting down top coal on a level, and was cutting it without setting props to protect himself when it gave way, crushing him. The fireman had been there an hour previous, and did not instruct him as to propping.	–	1	–	–	–	1
48	Nov. 25 6.30 a.m.	11th	Bamfurlong	Wigan	Cross, Tetley, & Co., Limited.	James Benbow	39	Packer	Inspection made and inquest attended. The deceased was a contractor's man, and was removing rubbish in the waste where props had been drawn, without securing the place, when the roof fell upon him.	–	1	–	–	–	1

List of Fatal Accidents—*continued.*

No. of Accidents.	Date and Hour of the Accident.	Hour of the Person's Shift, i.e., No. of Hours he had been at Work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Firedamp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above-ground.	Total.
49	1893. Nov. 15 10.30 p.m.	5th	Alliance	Wigan	The Alliance Coal and Cannel Co.	William Carlisle	17	Drawer	Inspection made and inquest attended. The roof fell upon the deceased near face of roadway, capping three bars, which were set about 3 feet apart, the roof in that roadway being very broken with slips.	–	1	–	–	–	1
50	Dec. 7 3.45 p.m.	10th	Low Hall	Wigan	Moss Hall Coal Co. Limited.	John Carter James Houghton	29 28	Collier Ditto	Inspection made and inquest attended. The deceased men were riding out in a gang of empty tubs, up a brow rising 1 in 7; when within 70 yards of the top the first drawbar broke, and the tubs ran back about five yards, the trailer causing one of the rails to be displaced, which penetrated through two of the tubs, and injuring the two men, who afterwards succumbed to the injuries received. The men will not be allowed to ride on this engine plane in future.	–	–	–	2	–	2
51	Dec. 11 11.0 a.m.	5th	Ashton Gran	St. Helens	Bromilow, Foster, & Co., Limited.	Thomas Howe	30	Collier	Inspection made and inquest attended. A piece of coal fell on the deceased when he was in the act of filling a tub. The seam was 5 feet thick, with a parting 2 feet from the top. It was part of the top section that fell, it having been allowed to overhang.	–	1	–	–	–	1

List of Fatal Accidents—*continued*.

No. of Accidents.	Date and Hour of the Accident.	Hour of the Person's Shift, i.e., No. of Hours he had been at Work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Firedamp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above-ground.	Total.
52	1893. Dec. 20 11.0 p.m.	5th	Eccleston Hall	St. Helens	Eccl eston Hall Colliery Co.	Davi d Jones	23	Drawer	Inspection made and inquest attended. A balance box broke loose in a brow, through a faulty link in a coupling chain breaking, and getting off the road, knocked some timber out, causing the roof to fall upon the deceased.	–	1	–	–	–	1

NORTH WALES.

No. of Accidents.	Date and Hour of the Accident.	Hour of Shift.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Explosions of Firedamp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above-ground.	Total.
1	1892. Dec. 20 9 p.m.	1st	Gwersyllt	Wrexham	Westminster, Brymbo Coal and Coke Co., Limited.	Robert Parry	64	Byeman	Inspection made and inquest attended. The deceased was attempting to get a piece of coal and clod down with an iron bar, which was overhanging on side of roadway, when he was caught before he could clear himself. He succumbed to the injuries received January 19, 1893.	–	1	–	–	–	1
2	1893. Jan. 7 8 a.m.	2nd	Ditto	Ditto	Ditto	Edward Roberts	34	Collier	Inquiry made and inquest attended. The deceased had been getting the clod down from above the coal, but had left a small portion which he thought secure, and while he was getting a hole stemmed in the coal, the same fell, fracturing his leg. He died at the Imfirmary on the 20th instant.	–	1	–	–	–	1

List of Fatal Accidents—*continued.*

No. of Accidents.	Date and Hour of the Accident.	Hour of the Person's Shift, i.e., No. of Hours he had been at Work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Firedamp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above-ground.	Total.
3	1893. Jan. 14 10.30a.m.	5th	Vron - -	Wrexham -	Vron Colliery Co., Limited.	Pryce Jones -	29	Holer -	Inquiry made and inquest attended. Deceased was in the act of holing under the main coal, against which he had set sprags, when a piece of coal which had been loosened by a shot going off previously, fell, striking him above the ankle, which had to be amputated. He died from shock and exhaustion on the 19th inst.	–	1	–	–	–	1
4	Jan. 20 11.30a.m.	5th	Bettisfield -	Bagillt -	Bettisfield Colliery Co., Limited.	Joseph Hughes -	15	Pony driver	Inspection made, and inquest attended. Deceased was in the act of coupling full tubs in a shunt, when he got crushed between the tubs, which were being shunted by a pony.	–	–	–	1	–	1
5	Feb. 1 6.15 a.m.	10th	Padeswood -	Mold - -	Padeswood Cannel and Coal Co., Limited.	John Edwards - Peter Hughes -	40 35	Repairer - Ditto -	Inspection made and inquest attended. The roof fell where they were working the pillars back, which liberated a quantity of sand and gravel which was about 16 yards above the cannel seam, suffocating the deceased through roadway being completely filled. Abandoned that district for safety, the cover being about 35 yards.	–	2	–	–	–	2

List of Fatal Accidents—*continued.*

No. of Accidents.	Date and Hour of the Accident.	Hour of the Person's Shift, i.e., No. of Hours he had been at Work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Firedamp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above-ground.	Total.
6	1893. Feb. 14 1 p.m.	7th	Hafod - -	Ruabon - -	Ruabon Coal and Coke Co., Limited.	Evan Owen -	48	Shiftman -	Inspection made and inquest attended. The deceased knocked a prop out supporting the top over a manhole, with the intention of ripping it higher; and when in the act of clearing some of the dirt out of same, a stone fell from under where he had taken the prop from between the two slips, causing injuries to which he succumbed on the 27th inst.	–	1	–	–	–	1
7	Feb. 18 9.15 a.m	4th	Mare Hey -	Hawarden -	Aston Hall Coal and Brick Co.	Enoch Messham -	46	Collier -	Inspection made and inquest attended. The deceased was in the act of getting the top coal down, which was about 4 feet thick, with an iron bar, when it suddenly gave way, falling upon him.	–	1	–	–	–	1
8	Mar. 18 7.30 p.m.	2nd	Bettisfield -	Bagillt - -	Bettisfield Colliery Co., Limited.	Edwin Roberts -	36	Collier -	Inspection made and inquest attended. Deceased was crushed by portion of top coal falling upon him while attempting to get it down.	–	1	–	–	–	1
9	April 4 11 a.m.	4th	Wynnstay -	Ruabon - -	Wynnstay Collieries, Limited.	Robert Jones -	54	Repairer -	Inspection made and inquest attended. The deceased and three other men were travelling up a brow, behind a journey of four full tubs, when a new gang rider carelessly unhitched the haulage rope before the journey properly landed; the tubs running back, caught the deceased before he reached the manhole. He succumbed to the injuries received the following day.	–	–	–	1	–	1

List of Fatal Accidents—*continued.*

No. of Accidents.	Date and Hour of the Accident.	Hour of the Person's Shift, i.e., No. of Hours he had been at Work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Firedamp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above-ground.	Total.
10	1893. April 17 5.30 a.m.	6th	Aston Hall -	Hawarden -	Aston Hall Coal and Brick Co.	Joseph Cooper -	35	Metalman -	Inspection made and inquest attended. The deceased and two other men were building a pack wall near face of a roadway, when portion of this ley stone fell to a slip, capping three props and crushing the deceased.	–	1	–	–	–	1
11	April 27 7 a.m.	1st	Hafod - -	Ruabon -	Ruabon Coal and Coke Co., Limited.	George Pemberton	23	Filler -	Inspection made and inquest attended. He was in the act of filling a tub of coal near the face, which had been standing a few days. The coal had been holed about 4 feet, with sprags set about 4 feet apart, when portion of the coal gave way over the sprags, crushing the deceased against the tub. Long sprags will be used in future as well as short ones.	–	1	–	–	–	1
12	April 28 10 p.m.	5th	Buckley - -	Buckley - -	George Watkinson and Sons, Limited.	Joseph Bellis -	55	Fireman -	Inspection made, and inquest attended. A large stone fell to a slip, on the deceased in a roadway, which he was examining at the time, during the night shift.	–	1	–	–	–	1
13	June 9 10.30 a.m.	5th	Westminster -	Wrexham -	Westminster Brymbo Coal and Coke Co., Limited.	George Davies -	23	Collier -	Inspection made, and inquest attended. The deceased was clearing some dirt, in order to get the top coal down, in which they had been boring a hole, when a crush took place; liberating a piece of top coal to a slip, which fell upon him. His father had examined it, and considered it quite strong.	–	1	–	–	–	1

List of Fatal Accidents—*continued*.

No. of Accidents.	Date and Hour of the Accident.	Hour of the Person's Shift, i.e., No. of Hours he had been at Work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Firedamp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Under-ground.	Above-ground.	Total.
14	1893. June 26 8 a.m.	2nd	Ffrwd	Wrexham	James Sparrow and Son.	Edward Manuel	65	Collier	Inspection made and inquest attended. The deceased was sitting against the coal face, watching his son drawing a prop in the pack, when a piece of coal and clunch fell from the roof from between three slips. They should have secured the roof near face before attempting to take the back props out.	–	1	–	–	–	1
15	July 7 7.30 a.m.	2nd	Ditto	Ditto	Ditto	Francis Jones	16	Points-boy	Inquiry made and inquest attended. Deceased was coupling, and attending to the boxes on top of brow. He apparently took the scotch out of front of two tubs before putting points right at top of brow, and running in front to put the points right, two of the tubs overtook him and knocked him down. These two he had omitted to couple to the others.	–	–	–	1	–	1
16	Aug. 11 9.30 a.m.	4th	Bettisfield	Bagillt	Bettisfield Colliery Co., Limited.	David Parry	30	Collier	Inspection made and inquest attended. The deceased was barring the coal down, when a portion fell against him, fracturing his leg, which had to be amputated. He died on the 14th inst.	–	1	–	–	–	1

List of Fatal Accidents—*continued.*

No. of Accidents.	Date and Hour of the Accident.	Hour of the Person's Shift, i.e., No. of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Firedamp.	Lives lost. Falls of Roof and Sides.	Lives lost. In Shafts.	Lives lost. Miscellaneous Underground.	Lives lost. Above-ground.	Lives lost. Total.
17	1893. Oct. 24 3 p.m.	8th	Flint	Flint	Flint Coal and Cannel Co., Limited.	Joseph Davies	18	Labourer	Inquiry made and inquest attended. The deceased had risen a bar of pitwood on his shoulder with another man, when he suddenly stumbled and fell, his head striking a knot of another bar lying on the floor. He died shortly afterwards from the injuries received.	–	–	–	–	1	1
18	Nov. 21 8.30 a.m.	3rd	Bettisfield	Bagillt	Bettisfield Colliery Co., Limited.	Peter Jones	47	Collier	Inspection made and inquest attended. The deceased was a contractor, working pillars out in the 5 yard seam. He had set two sprags under a piece of top coal which he had attempted to get down, when a squeeze came over the road, and portion of the coal fell upon him.	–	1	–	–	–	1
19	Nov. 29 1.15 p.m.	8th	Hafod	Ruabon	Ruabon Coal and Coke Co., Limited.	Sarah Williams	17	Screen-girl	Inspection made and inquest attended. The deceased was adjusting the coal on a loaded waggon, when five waggons were shunted by the Loco, and bumped against the waggon she was on throwing her off on to the ground, and she received such injuries that she died immediately afterwards. Stop blocks will be used in future.	–	–	–	–	1	1

List of Fatal Accidents—*continued.*

No. of Accidents.	Date and Hour of the Accident.	Hour of the Person's Shift, i.e., No. of Hours he had been at work when the Accident happened to him	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Firedamp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above-ground.	Total.
20	1893. Dec. 19 10 a.m.	8th	Hafod -	Ruabon -	Ruabon Coal and Coke Co., Limited.	Thomas Williams -	16	Putter -	Inspection made and inquest attended. The deceased was unloading a tub of props on a level in the Wall and Bench Seam, when a portion of metal from the side gave way to a slip, crushing the deceased.	–	1	–	–	–	1

Report of Assistant Inspector.

B15394a
18

Newton-le-Willows, Lancashire,
17th March 1894.

Sir,

In accordance with section 20 of the Metalliferous Mines Regulation Act, 1872, I have the honour to report that during the year 1893 I exercised the duties of Inspector of Mines in the district of West Lancashire and North Wales, and in so doing I have acted as assistant to and under the direction of Mr. Hall, the Chief Inspector in charge of the district.

I have, &c.,
D. H. F. MATHEWS.

The Right Honourable
Herbert H. Asquith, Q.C., M.P., &c.,
Her Majesty's Principal Secretary of State,
Home Office, Whitehall.

MINES.

REPORT

OF

ARTHUR H. STOKES, Esq., H.M. INSPECTOR OF MINES

FOR THE

MIDLAND DISTRICT (No. 8),

TO

HER MAJESTY'S SECRETARY OF STATE,

UNDER

The Coal Mines Regulation Act, 1887, the Metalliferous Mines Regulation Acts, 1872 and 1875, and the Slate Mines (Gunpowder) Act, 1882;

For the Year 1893.

Presented to both Houses of Parliament by Command of Her Majesty.

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1894.

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Mr. A. H. Stokes' Report.

REPORT on the INSPECTION of MINES in the MIDLAND DISTRICT, comprising the counties of Derby, Leicester, Nottingham, and Warwick, under the Coal Mines Regulation Act. Also the counties of Bedford, Berks, Buckingham, Cambridge, Derby, Hertford, Huntingdon, Leicester, Northampton, Nottingham, Oxford, Rutland, and Warwick, under the Metalliferous Mines Regulation Acts: By A. H. STOKES, Esq., F.G.S.

SIR, Green Hill, Derby, 15th March 1894.

I HAVE the honour to forward you the following reports upon the work of inspection of mines, and of my proceedings as Her Majesty's Inspector of Mines, in charge of the Midland District, during the year 1893. Such reports being made in accordance with section 43 of the Coal Mines Regulation Act, 1887, and section 20 of the Metalliferous Mines Regulation Act, 1872.

There has been a considerable decrease in the number of deaths which have occurred by accidents in and about the mines of this district during the year, as compared with the previous year, but such decreased number does not correctly represent the average death rate of the district, owing to a complete cessation of mining labour for a considerable portion of the year.

The list of accidents and deaths shows a decrease of 13 accidents and 15 deaths, which would be an unusual and very satisfactory saving of life provided it represented a full year's work. Upon referring to the ratio of fatal accidents and deaths to the number of persons employed and tons of mineral wrought, we find a contradictory statement, which requires explanation. The persons employed per life lost are 1,315, as compared with 1,022 in the previous year, showing 28 per cent. better result, whereas, taking the mineral wrought per life lost, we have 277,255 tons per life lost as compared with 297,618 tons per life lost in the previous year, showing 7 per cent. worse result. Therefore the number of accidents and deaths this year cannot be taken as a basis for comparison with previous years, unless in conjunction with the amount of mineral raised, or an allowance made for the long period of rest from mining labour which occurred during the autumn of the year.

The total output of mineral this year is considerably below the previous year, and little more than the quantity raised 11 years ago.

There have been 56 separate fatal accidents during the year, attended with a loss of 58 lives. Two accidents only were accompanied with the loss of more than one life. An explosion of gas resulted in the loss of two lives, and two persons were suffocated by noxious gases whilst endeavouring to extinguish a fire in the mine.

The following table shows the number of DEATHS due to accidents under various heads:—

Year.	Explosions of Firedamp.	Falls of Ground.	In Shafts.	Miscellaneous Underground.	On Surface.	Total.
1892	—	42	8	16	7	73
1893	2	26	5	17	8	58
Decrease -	—	16	3	—	—	15
Increase -	2	—	—	1	1	—

From the above table we see to what department of mining the decreased number of deaths is due, viz., falls of ground; and this is what might have been anticipated from the long absence of the miners from their working places.

There is one unsatisfactory feature in the above comparison, and that is the loss of two lives from an explosion of gas, which is an unfortunate break in the long period of immunity from such deaths which has occurred in this district.

The following table gives the quantities of the various minerals raised as compared with the previous year :—

Year.	Coal.	Fire-clay.	Ironstone.	Shale and other Minerals.	Total.
1892	21,587,967	119,383	14,363	4,409	**21,726,122**
1893	15,951,572	115,615	9,094	4,496	**16,080,777**
Increase -	—	—	—	87	—
Decrease -	5,636,395	3,768	5,269	—	**5,645,345**

The quantity of coal raised during the year was 15,951,572 tons, being a decrease of 5,636,395 tons as compared with the previous year, an unequalled decreased output due to labour dispute, and a remarkable quantity for a district which for many years has been steadily increasing the output, until it had nearly doubled the quantity of coal raised in a period of 20 years.

The total quantity of all kinds of mineral raised was 16,080,777 tons, a decrease of 5,645,345 tons, as compared with the year 1892.

The death rate in this district for the year is one for every 277,255 tons of mineral raised and in the United Kingdom it is one death for every 170,298 tons.

A detailed summary of deaths caused by accidents during the year will be found in Table No. 4, page 21, and a comparative table of the relative death rate due to the working of mines for many years will be found in Table No. 2, page 20.

TABLE No. 1.

The following table shows a comparison of the number of LIVES LOST per tons of mineral RAISED in the United Kingdom and the Midland District for the years 1868 to 1893 :—

Date.	Tons of MINERAL raised.		DEATHS.		Tons of Mineral raised per Death.	
	In the United Kingdom.	In the Midland District.	In the United Kingdom.	In the Midland District.	In the United Kingdom.	In the Midland District.
1868	104,566,959	7,699,265	1,011	60	103,429	128,321
1869	108,003,482	8,100,000	1,116	78	96,777	103,846
1870	112,875,525	8,366,000	991	50	113,900	167,320
1871	117,439,251	9,252,900	1,075	93	109,246	99,494
1872	123,393,853	10,657,100	1,060	79	116,409	134,900
1873	128,544,400	11,533,307	1,069	78	129,843	147,837
1874	126,214,368	12,232,296	1,056	55	119,521	222,405
1875	133,306,485	12,430,600	1,244	65	108,918	191,240
1876	148,989,385	12,500,055	933	77	159,688	162,338
1877	148,874,244	13,071,566	1,208	58	123,240	225,372
1878	145,789,138	13,575,320	1,413	55	103,257	246,824
1879	145,366,369	14,144,265	973	47	149,400	300,942
1880	161,466,793	14,623,260	1,318	59	122,509	247,852
1881	168,959,931	15,657,148	954	64	177,106	244,643
1882	171,334,032	15,702,084	1,126	138	152,161	113,783
1883	178,763,390	16,767,797	1,054	74	169,605	226,592
1884	174,872,759	16,198,131	942	55	185,390	294,511
1885	173,223,960	17,074,243	1,150	73	150,629	233,894
1886	170,006,959	16,854,312	953	63	178,391	267,528
1887	173,049,795	17,311,646	995	68	173,919	254,583
1888	182,660,163	18,201,685	888	61	205,698	298,388
1889	189,633,656	19,845,942	1,064	64	178,227	310,093
1890	194,605,887	20,659,836	1,160	65	167,763	317,856
1891	197,693,592	21,713,691	979	60	201,934	361,894
1892	191,954,908	21,726,122	982	73	195,473	297,618
1893	175,236,857	16,080,777	1,029	58	170,298	277,255

The quantity of minerals wrought in the years 1876–1893 includes coal, ironstone, and clay.

Inspection of Mines.

Inspection by H.M. Inspectors.

The duties appertaining to my office as Inspector in charge of the district have fully occupied me the whole of the year. All of the correspondence has passed through my hands,

and has been attended to. I have attended 27 inquests, and in nearly every case have personally visited the place where the accident occurred, and investigated the cause before attending the inquiry.

I have made 202 visits to mines, including both surface and underground inspections. I have also been engaged investigating workmens' complaints, attending solicitors' offices, magistrates sessions, and other appointments in connexion with the general enforcement and carrying out of the provisions of the Mines Act.

My duties have necessitated me being officially engaged from home on 308 days, and during that time I travelled by road and rail a distance of 16,029 miles.

I have had no holiday during the year.

I believe that two underground inspections, more or less complete, have been made of every coal mine in my district which was at work at the commencement of the year, many of the larger mines receiving a number of visits during the year.

A large proportion of the underground inspections made by my assistants are surprise visits, no notice whatever being given to either the manager or his officials of the intended visit of inspection. In fact, I have in some cases personally descended the shaft and commenced my inspection before either the manager or his officials knew of my presence at the mine. The number of inspections made by my assistants are stated below, and need no comment. Many of the inspections have nothing to do with any accident at the mine, and were made for the sole purpose of seeing if the provisions of the Act and Special Rules were being enforced.

The annual returns and statistical information contained in this report have all passed through my hands, and I have personally supervised the preparation of the Mineral Statistical Returns and other quantities and figures to be published in the yearly blue book, and for which each Inspector is reponsible with respect to the district under his charge.

Mr. W. H. Hepplewhite and Mr. H. R. Hewitt have assisted me in the work of inspection during the whole of the year, and I have pleasure in recording my acknowledgment of the valuable inspection work done by both of my assistants and the willing help afforded me by both gentlemen during the year.

The following record of work done by both Inspectors will show how actively they have been engaged.

Mr. Hepplewhite reports :—

"I was officially engaged on 303 days during the year.

"I made 247 underground and 41 surface inspections.

"I attended 14 inquests, and office work and other appointments occupied me on seven days.

"I have had four days' holiday, and travelled by road and rail 16,292 miles upon official duties during the year."

Mr. Hewitt reports :—

"I was officially engaged on 284 days.

"I made 237 underground and 44 surface inspections.

"I have attended 18 inquests.

"I travelled 12,796 miles by rail and road during the year.

"I have had 14 days' holiday, and was away from duty for eight days in consequence of domestic and personal illness."

The underground inspections made by my assistants are in nearly all cases visits of systematic inspection, frequently visiting every working place in smaller mines and every working place of a district in the larger mines.

During the 16 weeks' cessation of work, my assistants were engaged inspecting the metalliferous mines of the district.

Inspection by Workmen.

The privilege given to workmen by General Rule No. 38, to inspect the mine in which they work, or to appoint two practical miners to inspect the mine, is seldom exercised by the miners of my district, and, with a few exceptions, no such inspections are made. I have not during the year received a copy of any reported danger, and therefore I presume where such inspections have been made the workmen could not have reported the existence or apprehended existence, of any danger, or I should have received a copy of their report from the owner, agent, or manager of the mine.

Workmen's Complaints.

During the year I have received a number of workmens' complaints, both anonymous and signed. In all cases they have received the earliest possible attention, and in most cases I have personally inquired into the subject of the communication.

Such communications, whether anonymous or signed, receive equal attention, and are always treated as confidential information, but I again repeat that such letters should specify

the nature and locality of the complaint as a guide to the Inspector when visiting the mine; for it is clear that few workmen can have a sufficient knowledge of the ramifications of the whole mine, and understand its works so as to enable them to make a general complaint of mismanagement and neglect. Workmen may occasionally give valuable information with respect to any particular breach of the Mines Act, or the anticipation of any danger to the miners or the mine, and by calling the Inspector's attention to such matters receive an early visit and investigation.

The workmen of this district have no ground of complaint with respect to their communications to the Inspector of Mines, for all are treated alike and investigated.

Accidents.

Time of Shift in which Accidents occur.

The time of the shift in which each fatal accident occurred will be found entered in the list of fatal accidents (Appendix II.), but for the purpose of general comparison I have tabulated the information, and give it in a form which shows at a glance the number and per centage of deaths for each hour of the shift during the whole year.

Hours of the Shift, that is during what Hour after the commencement of their Shift the Fatal Accidents happened to Persons employed in and about the Mines of the Midland District.

Hour of the Shift.	Underground.												
	1st Hour.	2nd Hour.	3rd Hour.	4th Hour.	5th Hour.	6th Hour.	7th Hour.	8th Hour.	9th Hour.	10th Hour.	11th Hour.	12th Hour.	More than 12 Hours.
Total deaths - -	5	7	4	6	5	8	3	5	4	1	–	–	–
Per-centage - -	·10	·15	·08	·13	·10	·17	·07	·10	·08	·02	–	–	–

Hour of the Shift.	Aboveground.												
	1st Hour.	2nd Hour.	3rd Hour.	4th Hour.	5th Hour.	6th Hour.	7th Hour.	8th Hour.	9th Hour.	10th Hour.	11th Hour.	12th Hour.	More than 12 Hours.
Total deaths - -	–	–	1	2	2	1	1	–	–	1	–	–	–
Per-centage - -	–	–	·12	·26	·26	·12	·12	–	–	·12	–	–	–

Accidents upon resuming Work.

Strong fear was entertained, both by myself and managers in the district, that upon the resumption of work after the long cessation of labour there would be a large number of accidents, especially from falls, but this was not so, and work was resumed without any serious calamity or abnormal increase in the number of accidents. I cannot but think that this good result was in a large measure due to the continued employment of all the officials of the mine during the period the mine remained unworked, and to their supervision and labour in keeping the mine in repair, also to the workmen themselves, who, in most cases, had their attention called to the danger of undue haste, and who appear to have anticipated the effect of a long stand by carefully securing the safety of their working places with a plentiful supply of timber.

Explosions of Firedamp.

I regret to have to report that I have this year to record the death of two persons from explosion of firedamp, and, strange to say, not in one of the most fiery mines in the district, but in a mine in which gas was only occasionally found.

There have been seven non-fatal explosions during the year, none of them calling for special remarks beyond the note attached to each on Table No. 7. All the explosions were of a slight nature, but sufficient to prove that the daily search for gas, the strict enforcement of General Rule No. 8 of the Mines Act, the adequate ventilation of the workings of the mine, and constant watchfulness is absolutely essential in all mines if accidents from firedamp are to be avoided.

The immunity from deaths due to explosions of firedamp which has been enjoyed by this district since April 4th, 1887, a period of 5 years and 10 months, was broken by a serious explosion on the 11th February last, causing the loss of two lives.

The explosion occurred in one of the main haulage roadways of the Whitwick Colliery, Coalville, Leicestershire, and about 400 yards from the bottom of the downcast shaft, the roadway being the main intake airway for a large district of the mine.

The coal worked is the "Roaster" seam of the Leicestershire coalfield, and was considered so free from firedamp that the management had for years worked the mine by the use of naked lights.

The explosion occurred on Saturday, the 11th February. The district of the mine where the explosion took place was not at work at the time of the accident, and there were only seven persons (including the two deceased) in the workings, hence the small loss of life.

Two boys were taking their horses, with two barrels of water, along the main haulage roadway of the district, when a fall of roof occurred a few yards in front of them. This fall liberated a quantity of gas which appears to have accumulated, unknown to the officials, in the strata above the timbering of the roadway. The gas ignited at the boys' naked lights, killing both boys and their two horses instantly, and doing damage to a number of tubs on the roadway.

The under-manager, his deputy, and three workmen were in the workings of the district some distance away, and felt the effects of the explosion. They immediately went in search of the two boys, but had to retreat in consequence of afterdamp, and make their escape by the return airway.

The haulage roadway is well ventilated, and the explosion occurred under conditions, and at a place, where neither the manager nor his officials anticipated danger from firedamp.

The effects of the explosion were limited by the quantity of gas which appears to have been liberated by the fall of roof, but had the mine been in full work at the time of the explosion, I have reason to think that many more lives would have been lost.

The mine has been very free from gas for some years, and consequently worked with naked lights. The under-manager, in his evidence at the inquest, stated that "gas had not been " reported to him as existing in that district for the last four years."

It was difficult at first to explain so serious an explosion in the main intake and haulage roadway of a mine which had been so free from gas, and in a roadway where there was over 10,000 cubic feet of air passing every minute.

The part of the roadway where the fall occurred was well timbered, but the roadway was wet and had a soft floor. A few yards above the timber of the roadway there was another seam of coal, and from which gas probably issued. The timbers supporting the roof of the roadway appear to have been for some time slowly sinking into the soft floor, which was occasionally taken up to make height of road. The roof resting upon the timber also appears to have been slowly sinking with the timber, leaving a cavity between the coal and the strata above the roadway. This cavity filled with gas, and it only remained for an outlet to be made for the gas to find its way into the roadway or haulage road.

Upon inspection of the fall after the explosion it was clearly seen that the coal seam a few yards above the roadway was not broken through, and had formed the roof of a cavity which had probably for some time been slowly increasing in size and filling with gas. The weight of the superincumbent strata above the timber had caused some of them to give way at a time when the two deceased were about to pass under it, and being on the in-bye side of the strong air current, the explosive gas above the timbers was carried towards the deceased, who were advancing towards it with their ponies, and who, in a few seconds, would have passed under it and beyond the danger.

The fall after the explosion was nearly 40 yards long, but it is probable that only a small fall occurred previous to the explosion, and that the cavity over the roadway extended for the whole length of the fall, allowing the full force of the explosion to extend into and along the whole length of such cavity, and exert its power in crushing down the timber supporting the roof of the roadway.

The under-manager of the mine passed through the road and under the timber a few minutes before the accident, and stated that all was apparently safe.

The inspection of the mine after the accident not only showed that the strata had sunk from the overlaying seam of coal, but the cavity formed by the fall was found to be full of firedamp in a few hours after the explosion, and such indications formed the ground for concluding that the accident was due to the slow sinking of the roof of the roadway; and accumulation of gas issuing from the coal seam a few yards above the roadway.

The peculiar conditions under which this explosion occurred cannot be too widely known amongst miners working with naked lights, for in this case we have a district of a mine in which gas has not been found for four years—a main intake roadway with a large volume of air passing along—and yet upon a sudden fall of roof occuring it liberates a quantity of pent-up gas, which the strong current of air drives forward to the naked lights of two pony boys, where it ignites with fatal and damaging effect.

Such an accident occurring in a mine so free from gas supports the strong precautionary measures which have been suggested for adoption in all mines, viz., that no lights, other than a locked safety-lamp, should be used in any seam of a mine in which firedamp has been found at any time within the previous 12 months, and then only in accordance with General Rule Nos. 10 and 11 of the Mines Act.

Falls of Roof and Side.

The number of deaths from falls is 26, or 16 less than in the previous year, a decrease of 38 per cent. This is a very satisfactory decrease in number, but when compared with the number of tons drawn per life lost from falls for the previous year, it does not compare so favourably, being an increase of only 19 per cent. of tons drawn per life lost; the large decrease in numbers is in a great measure due to the 16 weeks cessation of work, when no men were in the mines, and therefore the decrease in numbers is not the proper datum upon which to calculate the good or bad results with respect to falls of roof and side.

The large number of deaths from falls is a matter of serious consideration, and a perusal of the cause of each accident in Appendix II. will show that a number of such deaths are apparently due to the deceased persons' neglect to take the precautionary measures imposed upon them by the Special Rules.

Accident No. 11.—In this case the deceased was attempting to withdraw a back prop or support to the roof, and instead of using a "ringer and chain" as required by Special Rule No. 71 he attempted to cut it out with a pick.

It is strange that men after having set timber to support the roof, and allowed it to settle upon such supports, deliberately go under the roof and cut away the prop, whereas, by the use of a ringer and chain, they might pull it out with safety whilst standing under another part of the roof which is adequately supported.

The number of deaths which occur under similar circumstances caused the following rule to be inserted in the Special Rules when revised after the passing of the last Mines Act.

"Special Rule No. 71.—No person shall withdraw, or attempt to withdraw, from out of any waste, or from under any heavy roof, any timber in use for supporting the roof, except by means of a ringer and chain."

If such rule be strictly carried out the death rate from falls of roof would, in my opinion, be lessened.

Accident No. 12.—The deceased was working under overhanging coal, which had been left unspragged, contrary to Special Rule No. 72. Had the deceased man strictly carried out the above-named Special Rule, there is every probability that his life would not have been lost.

Accident No. 52.—The deceased man was warned by an official of the mine of the danger of holing coal without being sufficiently protected by holing sprags, but, unfortunately, he did not attend to the warning, and the official, relying upon the man to set the timber, did not remain until the danger was removed.

The miner's occupation will always be open to serious danger from falls of roof and side, and therefore it is necessary not only that the Special Rules which have been framed for the protection of life should be strictly enforced and carried out, but the men themselves, having daily experience of the roof under which they work, should adequately protect their working place by a judicious and plentiful use of timber to support the roof and sides.

In this district it is the duty of the stallmen in each stall or working place to build efficient packs and set a sufficient quantity of props, bars, or timber, for safely supporting the roof and sides of their working places, and remove and renew the same when necessary. Therefore the reduction of accidents from falls in a great measure rests with the workmen in charge of working places; but it is also necessary that the officials of the mine should do their duty by seeing that a good supply of suitable timber is provided for the workmen's use at a place convenient to each working place, and when passing through the mine to exert a diligent and never-ceasing search for any defect or scarcity in the timbering of the working places, and upon each visit ascertain that a plentiful supply of suitable timber is within easy reach of the workmen.

If accidents from falls are to be reduced it must be by the joint co-operation of both officials and workmen, and a united desire to strictly enforce and carry out the rules with regard to timbering and securing the safety of the working places.

Shafts.

The deaths from accidents in shafts are five, being a decrease of three as compared with the previous year.

The small number of accidents in shafts is remarkable when we consider that upon every working day in the district upwards of 60,000 persons are lowered and raised through shafts.

I have obtained from the mines in my district a return of ropes broken and over-windings for the last three years, and give the information in a form for easy reference.

WINDING ROPES BROKEN, and NUMBER of OVER-WINDINGS at the Mines comprising the Midland District:—

Winding Ropes Broken.			Number of Over-winds.		
1891.	1892.	1893.	1891.	1892.	1893.
5	3	4	10	9	24

The whole of the ropes broke at a time when no men were on the cage, and therefore, happily, no loss of life occurred.

Nearly the whole of the over-windings took place at mines where detaching hooks were in use, and, with one exception, the hook acted satisfactorily. In one case the hook failed to act, and the cage fell down the shaft, doing considerable damage.

In one case 12 men were descending the shaft to go to work when the engineman over-wound the ascending empty cage, and caused the descending cage, loaded with men, to drop so violently at the bottom of the shaft as to more or less seriously injure the whole of them. There had been a dispute between the enginemen and the colliery company to whom the mine belonged. The men gave in their notices and left their employment, together with a number of winding enginemen at other mines belonging to the same company. In the meantime the manager had procured men from a neighbouring county to take the places of the old enginemen, and it was one of these new men who was working the engine when the accident took place. Other over-windings had occurred at the company's mines, but without doing any damage. After the injury to the men named above the workmen claimed to have the old enginemen reinstated, and after two days' cessation of work the company agreed to reinstate the enginemen, and I am pleased to say no further case of over-winding has occurred at any of their mines.

The marvellous escape of four men in a sinking shaft at the Griff Colliery, Nuneaton, is worthy of record, and I give the particulars in the manager's own words when reporting the circumstances to me.

"In letting down the 'bowk' (sinking tub) empty, the engineman appears to have started before receiving a signal from the banksman, and the 'bowk' caught on the edge of the 'tacking' (cover which runs over the top of the shaft), turned over, and fell on to the hook, breaking the same, and fell down the shaft, now 205 yards deep.

"There were four men in the bottom, and they crouched round and behind the water barrel which stands in the shaft bottom to receive the water from above, while the 'bowk' fell into the centre of the shaft, not even touching the water barrel, and the men were absolutely uninjured."

My investigation of the breaking of winding ropes leads me to the conclusion that the life of such ropes is one of the most important factors when considering its safety, and that more ropes break from weakness, due to internal corrosion, than from being worn out. No time can be stated for the life of any winding rope; its material may be such that it would require taking off in a few months, or it may show little external wear when used its allotted time. Many managers fix a maximum of from two to two and a half years for the life of a good rope, their idea being that should internal corrosion be taking place at any point of the rope, such period of time was sufficient for a limit of safety, and they also periodically re-cap the rope to alter the point of pick-up on the pulley wheel, and test the quality of the rope at the end next the cage.

In my opinion such managers are right in considering that a danger which cannot be seen, such as internal corrosion, or wear from friction under stress of flexure, should be guarded against by a maximum limit of time. The outside wear or breakage of wires can be seen, if carefully examined, but the internal deterioration a rope may be undergoing cannot be seen, and its weakness from such causes must be anticipated and provided for by a time limit which will keep its breaking strain well within the minimum margin of safety.

Blasting Underground.

There have been eight non-fatal and two fatal accidents from the use of explosives underground during the year.

Accident No. 56.—In this case the deceased was an official of the mine, and authorised to fire shots. The mine is worked with safety lamps, and the shots are fired by means of "germans," and for the purpose of igniting the german the deceased used a short length of cotton lamp-wick, prepared into "touch" by soaking it with saltpetre. The deceased lighted the lamp-wick at the lamp station and carried it with him (burning) when going to

fire shots. The "germans" are made of newspaper saturated with saltpetre and filled with gunpowder, the end being turned up, which is supposed to give sufficient time for the shot-lighter to get clear away before burning within reach of the gunpowder. In this case deceased fired a shot prepared in the usual manner, and which appears to have exploded before he could get away, for he was found fatally injured directly opposite the shot, after it had exploded.

It appears probable that the deceased lighted the end of the "german" next the gunpowder, and not the extreme end of the touch-paper, or that the current of ventilation caused sparks to fly from the burning lampwick that he carried in his hand.

I have repeatedly called attention to the danger of using "germans" made solely of touch-paper, and to the greater degree of safety secured by using double tape gunpowder fuze, and I have little doubt that had this man used fuze his life would not have been lost.

Explosives.

The use and description of explosives used in a mine is a matter which requires serious consideration. There appears to be a growing demand for a safe, effective, and economical explosive, but at present we are far from having reached the maximum of either safety, efficiency, or economy, or restricted their use to the minimum required for the development and working of the mine. Great strides have been made within the last few years in the attempts to produce a safe explosive, but at the present moment I am not aware that we have an absolutely flameless explosive, or one by which infallible security may be attained during blasting in a mine.

The chief element of danger in connexion with blasting operations is the production of a flame of high temperature, which may ignite inflammable gases in the vicinity of a shot, or by the concussion of the shot in dusty places raise sufficient dust to convert an atmosphere only slightly charged with gas into an inflammable mixture.

Recent experience leads me to think that gunpowder should be prohibited from use in all fiery and dusty mines, and although we have high explosives which, with care and under stringent regulations, might be used, yet all such shots should be fired by an official of the mine, who has been taught the nature and power of such explosives, for miners are liable to use a high explosive for a given amount of work in the same proportion as they would use gunpowder, and with the frequent result that explosives are wasted and the element of danger from a blown-out shot, or exposure of flame of intense heat which would result from an overcharged shot, is intensified.

Miners accustomed to gunpowder all their lives scarcely understand the power of a high explosive, and do not consider the importance of using the minimum quantity of such explosive substance to perform the work required, neither do many men appreciate the importance that stemming or ramming should consist of damp non-inflammable material, and that the first part of the tamping should be introduced in small proportions, to prevent the compression of air at the bottom of the shot-hole.

In mines worked with safety lamps, all shots should, in my opinion, be fired by electricity, and low-tension fuzes, for the employment of ordinary gunpowder fuze is liable to emit sparks at the moment of ignition, which will ignite gas, and the incongruity of prohibiting a man from using a naked flame to light the end of a fuze, which, when lighted by a red-hot wire, is equal to a naked flame, cannot be justified, especially when we have at command electrical exploding appliances which are both safe and efficient, and present many advantages as regards safety over any kind of fuze which emits sparks that will ignite gas, or which cannot be ignited except by the application of flame to its extremity. The simplicity and certainty of firing by the low-tension system of electrical blasting commends itself to all who have adopted its use. The electric fuze can be safely tested by a galvanometer before being taken into the mine, and little fear need be entertained that the operatives will be troubled with mis-shots, and the weight of the firing apparatus need not prevent its general use.

Miscellaneous Accidents.

There have been 17 accidents of a miscellaneous character, many of them not calling for further explanation than that given in the list of accidents, Appendix II.

Suffocation by Gases.

Two persons lost their lives by suffocation in the Manners Colliery, Ilkeston, Derbyshire, whilst endeavouring to build a stopping in an old roadway. A fire had been discovered in the mine, which made such rapid progress that every endeavour to put it out by water

failed, and as it rapidly extended along the roadway the only resource left was to dam off the district by means of stoppings. The two deceased persons were sent to make a stopping air-tight in an old roadway on the return side of the fire. The deceased appear to have done their work, and were coming back, and in doing so would have to pass the entrance to another old roadway. It appeared as if the completion of the stopping had forced the noxious gases out of the old roadway, although stowed up, and that deceased were killed by those gases on returning from the stopping they had been making secure.

The distance from the main airway was only short, and considering that a man at the entrance to the roadway had been affected by the noxious gases previous to the deceased being sent to work, it was to be regretted that an official of the mine was not sent with the deceased to watch and test the ventilation whilst they were securing such an important stopping, and one that was intended to press back the noxious gases, and thus damp the fire out.

Neither the manager nor his officials could advance any theory as to the origin of the fire; no naked lights were allowed to be carried along the part of the roadway where the fire originated, and when the fire was first discovered it appeared as if it arose from some full tubs of coal that stood in the roadway. From the time the miners left their work until the fire was discovered was a period of nearly 30 hours, and during that time no official had examined that part of the mine, because the miners were not getting coal, and the origin of the fire remains a mystery, but it indicates that an official inspection is desirable at the usual interval after men have left their work, although the mine may cease work for a day. Had this been done in this case the fire would have been discovered many hours before, and probably extinguished without either loss of life or the closing of a working district of the mine.

Machinery Accidents.

Accident No. 25.—I have again to record the death of a man from injuries received whilst attempting to put a leather belt on a revolving pulley. It appears strange that men will run such risks for the sake of a few minutes time taken up by stopping the machinery and adjusting the belt without difficulty or danger. Where loose pulleys are not in use the machinery should always be stopped before men attempt to attach a belt to a driving pulley, or the revolving pulley and shaft should be completely protected by fencing.

Accidents by Railway Waggons.

Two deaths occurred from being crushed between railway waggons and the posts or pillars supporting the coal screens. I have frequently pointed out to managers that where men have to lower and adjust railway waggons under screens sufficient room should be provided to allow men to travel with safety by the side of the waggon and between the waggon and the screen posts. Men in charge of moving railway waggons under and about coal screens should always bring them to a stand before leaving them, and not allow them to run uncontrolled into or out of the screens because they have no room to pass or accompany them until fixed or lowered into position.

Coal Dust and Explosions.

I am not aware that the Royal Commission appointed to inquire into the effects of coal dust and explosions have done more than publish the Minutes of Evidence, dated 30th July 1891. The Commission was appointed on the 9th February 1891, and until their report is issued it would be inopportune on my part to offer any remarks or suggestions upon a question which appears to require long and serious consideration.

Cessation of Work.

The present year will be memorable for the character, dimensions, and duration of the conflict between capital and labour which commenced on the 28th July and terminated on the 20th November, a period of 16 weeks.

The unsatisfactory state of the coal trade in June caused nearly every coal owner in this district to join a federation of owners, who met the Miners' Federation to consider a proposal for the reduction of wages, but having failed to agree, the coal owners passed a resolution demanding a 25 per cent. reduction in the rates of miners' wages throughout the districts covered by the Federation. The miners as a body resolved to resist the coal owners proposal, and on the 28th July commenced a general cessation of work throughout the whole of this district, and for many weeks coal drawing (with the exception of a few very small mines) practically ceased, and the miners and their dependents entered upon a contest which for its magnitude, uncompromising attitude of both sides, and far reaching effects, has never been equalled in the history of the district.

In this district the wages had been increased by various per-centages until at the commencement of the dispute they stood at 40 per cent. above the wage paid in 1888. The increases may be taken as the following :—

Per-centages advanced.

—	Derby.	Leicester.	Notts.	Warwick.
1888.	Per cent.	Per cent.	Per cent.	Per cent.
October - -	10	10	10	10
1889.				
March - -	—	—	5	—
July - - -	5	5	—	5
September - -	—	5	5	—
October - -	5	—	—	—
November - -	—	—	—	5
1890.				
January - -	10	10	10	10
March - -	5	5	5	5
August - -	5	5	5	5
Per-centage advanced -	40	40	40	40

Many miners did not at first clearly understand whether the reduction of 25 per cent. meant a reduction of one-quarter of the total wage earned or a lowering of the advances from 40 per cent. to 15 per cent. above the rate of 1888, but the owners' Federation made it clear that they demanded the reduction from the advances, and not off the gross wages. The true issue soon became apparent, and both sides prepared for a long cessation of work. On the owner's side, the ponies were withdrawn from the mine and all labours ceased beyond the officials for examining the workings and doing necessary repairs for the safety of the mines. On the miners' part the men refrained for a short period from drawing pay from the accumulated funds in their union, so that they might be better prepared for a long term of absence from work.

There appeared to be an unanimity of feeling amongst the miners that the stoppage of coal production should be as general as possible, and therefore all miners under the direction of the Federation left work, and the whole of the mines in the district (excepting a few small places) ceased to draw coal.

In the last week of September it was decided by the Miners' Federation that men should resume work at those mines where the old rates were offered, and in a few days some of the mines commenced work at the old rate of wages. This was the beginning of the end; others were preparing to, or had resumed work, when a joint conference of owners' and miners' representatives met in London on November 17th, when it was decided that the men resume work at once at the old rate of wages until February 1st, 1894, and on the following Monday, November 20th, the whole of the mines in the district were re-opened for work, after 16 weeks' cessation of labour.

The result of such a stoppage of coal production is seen by a decrease of 5,636,395 tons of coal in the total output of the district when compared with the previous year, for although every exertion was put forward to raise the maximum quantity each mine would produce directly work was resumed, yet it was beyond the power of the miners to make up such a serious deficiency in the year's output.

The total economic loss to the country cannot be known, but the magnitude and duration of the dispute was such as to affect, and in some cases stop, many trades where coal is used.

The total reduction of output for the United Kingdom was 17,461,076 tons, which is about 10 per cent. of the total output of the country, a decrease sufficient to create a coal famine over a large area, and advance the cost of coal to prohibitive manufacturing price, to stop many industries, to seriously threaten the railway traffic, and place many towns in jeopardy of failure of gas supply. We see from such a suspension of mining labour how important our coal supply is for the prosperity, and even existence, of our manufacturing industries.

No body of men are more important to the country's welfare than the miners, and the very foundation upon which our national prosperity has risen, and still rests, is that of our mineral resources, and therefore it is to be sincerely hoped that the mine owners and the miners may never again experience such a suspension of labour, and that their failure to agree to matters in dispute may be settled by some description of conciliation board, and not by exhaustive trials of pecuniary or physical endurance.

Directly the mines in the district ceased to draw coal there appeared an unusal amount of activity displayed by would-be mine owners, searching for coal either at the outcrops of the seams, or by opening out thin seams which had previously been abandoned or thought unworkable, and during the months of October and November, nineteen such mines were opened, many of them to be closed again before the end of the year. Fuel became so scarce in the district that the miners dug over the old pit banks, and carried away anything of the character of coal that would burn.

Railway companies, although relieved of mineral traffic, cannot run fewer passenger trains, except within narrow limits, and are entirely dependent upon coal in order to carry on their business at all. The railways in the district suffered considerable loss of traffic, and their stocks of coal were heavily drawn upon without compensatory replacement.

There was one pleasing feature which was noticeable during the cessation of work, viz., the liberality of the charitably disposed towards providing food for the children of the miners. It appeared to be generally conceded that the miners' children could in no way influence the result, and that the physique of the rising generation, for which the country must depend upon to supply the future sons of toil, should not suffer hunger to such a degree that would probably impair their physical strength in after years. In many cases provision was made either at school or other convenient place to periodically feed the children, and a large amount of food was in this way distributed, and although the public had many calls upon them, yet they continued to liberally respond to such calls to provide food for the children.

Number of Days in each Month on which Coal has been drawn.

The annual return to be filled up by the owners, agent, or manager, and sent to the Inspector, provides for the number of days in each month on which coal or ironstone has been drawn, to be given for the year, and from such returns I have tabulated the following information :—

Average number of days worked, 1893.

County.	Jan.	Feb.	Mar.	April.	May.	June.	July.	*Aug.	*Sept.	*Oct.	Nov.	Dec.	Total for the Year.
Derbyshire - - -	22½	18½	20	15¾	15¾	16	23	18	16½	20½	17¾	21¾	**226**
Leicestershire - - -	20½	16½	18½	13¾	13¼	13	16½	20¼	26	14¼	25	21½	**219**
Nottinghamshire - -	22	17¾	18	14	14½	16	19½	8	8¼	16¾	18½	20¾	**194**
Warwickshire - - -	22¾	19½	21	17	18¼	18	21½	22¼	19½	18	26	21¼	**245**

* The average days for August, September, and part of October refer to a few small mines.

Technical Education.

The classes for technical instruction in mining formed in Nottinghamshire and Warwickshire are being continued with success under the direction of the county council.

At the conclusion of last sessions' work an optional examination of the students took place similar to the previous year, but including two grades of proficiency, and with the following results :—

NOTTINGHAMSHIRE. Lecturers: Messrs. H. Stoker, B.Sc., and C. Latham.				WARWICKSHIRE. Lecturer: Mr. G. M. Bailes.			
Elementary.		Advanced.		Elementary.		Advanced.	
Students Examined.	Students obtained Certificates.	Students Examined.	Students obtained Certificates.	Students Examined.	Students obtained Certificates.	Students Examined.	Students obtained Certificates.
126	110	138	112	53	44	26	20

The second year's work was so encouraging that a third year's course of instruction has been entered upon, and with equal prospect of success. Much of the success of the technical instruction in mining is due to the lecturers being themselves practical men, who can not only speak to the miners in their own technical terms, but illustrate and popularise their instruction

by homely and practical descriptions of mining as seen by themselves when visiting the mines in which their students work.

The lecturers in both counties have done good work, and many young men are now obtaining mining instruction which will enable them to obtain official positions in the mines or secure under-managers' or managers' certificates at some future day.

Weighing.

I find from inquiry when inspecting mines that the examination and testing of the weigh machines used for determining the wages payable to persons employed in the mine is carried out in accordance with section No. 15 of the Mines Act, and in most cases the result of such examination is posted up in the weigh house upon a special form of certificate, signed by the Inspector of Weights and Measures.

Prosecutions.

I am pleased to say that I have not considered it necessary during the year to ask for your sanction to take legal proceedings for breaches of the provisions of the Coal Mines Regulation Act, 1887.

My assistant, Mr. Hewitt, reported to me that whilst inspecting the Ibstock Mine, Ashby-de-la-Zouch, Leicestershire, on the 2nd June last, he found some of the horses in the mine working under conditions which, in his opinion, was cruelty to animals. There had been previous complaints with respect to the treatment of animals in this mine, and therefore I reported the case, and received your instructions to place the matter in hands of the constabulary of the county, so that proceedings could be taken under the Act for the prevention of cruelty to animals.

The manager, under-manager, and horse-keeper were charged with cruelty to six horses by causing them to be worked in an unfit state, and the cases were part heard at the Market Bosworth Police Court on the 12th July.

The first case taken was that against the horse-keeper, and after hearing the case the magistrates convicted the man, but before the penalty was stated it was discovered that the informations in all the cases had been laid two days beyond the statutory time (one calendar month); this error proved fatal to the case, and all the proceedings were quashed.

The following prosecutions of workmen have been reported to me during the year, in accordance with section 66 of the Coal Mines Regulation Act, 1887:—

Date.	Occupation of Offender.	Nature of Offence.	Rules.	Result of Hearing.	Amount. Fine.	Amount. Costs.
1893.					£ s. d.	£ s. d.
Jan. 7	Pony driver	Cruelty to animals (under Cruelty to Animals Act).	—	Convicted	0 7 0	0 8 0
" 7	" -	" " "	—	"	0 7 0	0 8 0
" 14	Stallman -	Unramming a shot which had missed fire.	Gen. Rule -	"	0 2 6	0 17 6
" 14	" -	" " " -	No. 12 (*e*) -	"	0 3 6	0 16 6
Feb. 2	Holer -	Holing without sprags for a distance of 4 yards.	Sp. Rule 73 -	"	0 2 0	0 19 0
" 2	" -	" " " -	Sp. Rule 73 -	"	0 2 0	0 19 0
" 6	Stallman -	Holing without setting sprags	Sp. Rule 72 -	"	0 5 0	0 18 0
" 6	Pony driver	Cruelty to animals (under Cruelty to Animals Act).	—	"	0 5 6	0 9 6
" 15	" -	Damaging an incline rope, by having chopped it partly in two.	Sp. Rule 5 -	"	(Six weeks' imprisonment with hard labour.)	
" 15	Stallman -	Attempting to withdraw a prop from a waste without using a ringer and chain.	Sp. Rule 71 -	"	0 10 0	0 9 6
" 18	Jigger -	Neglecting to couple certain full tubs together.	Sp. Rule 91 -	"	0 0 6	0 9 6
" 18	" -	" " " -	Sp. Rule 91 -	"	Nil	0 5 0
" 27	Stallman -	Taking tobacco pipe into workings where safety-lamps are used exclusively.	Sp. Rule 55 -	"	1 0 0	0 10 6
Mar. 4	Loader -	Walking in front of a full tub when taking it down an incline.	Sp. Rule 79 -	"	Nil	0 12 0
" 4	" -	Taking matches into a mine where only safety-lamps are used.	Sp. Rule 55 -	"	0 4 6	0 15 0

Date		Occupation of Offender.	Nature of Offence.	Rules.	Result of Hearing.	Amount. Fine.	Amount. Costs.
1893.						£ s. d.	£ s. d.
Mar.	10	Stallman -	Taking a naked light beyond a "fire" board.	Sp. Rule 63 -	Convicted	0 5 0	0 11 6
„	16	Pony driver	Working without a "drag" on his train of full tubs.	Sp. Rule 86 -	„	0 5 0	0 14 6
„	18	Stallman -	Not examining his stall before commencing work.	Sp. Rule 67 -	Dismissed	—	—
„	25	„ -	Neglecting to sprag overhanging coal.	Sp. Rule 72 -	Convicted	0 7 6	0 13 6
„	25	„ -	„ „ „ -	Sp. Rule 72 -	„	0 7 6	0 13 6
April	14	„ -	Leaving a door open in the mine	Sp. Rule 76 -	„	1 0 0	0 17 6
„	14	„ -	„ „ „ -	Sp. Rule 76 -	„	1 0 0	1 0 6
„	14	Holer -	Refusing to leave the cage when ordered to do so.	Sp. Rule 63 -	„	0 10 0	1 3 6
„	20	„ -	Holing without settings sprags	Sp. Rule 73 -	„	0 0 6	1 19 6
„	20	Stallman -	Having holing sprags 8 feet apart.	Sp. Rule 77 -	„	0 10 0	0 9 6
„	23	Holer -	Neglecting to set holing sprags	Sp. Rule 73 -	„	Nil	0 13 0
„	24	Stallman -	Neglecting to set holing sprags before starting work.	Sp. Rule 72 -	„	0 5 0	0 12 0
May	1	Holer -	„ „ „ -	Sp. Rule 72 -	„	0 5 0	0 9 6
„	1	Stallman -	Leaving overhanging coal unspragged.	Sp. Rule 72 -	„	0 5 0	0 9 6
„	1	„ -	Neglecting to set holing sprags	Sp. Rule 73 -	„	0 5 0	0 9 6
„	26	„ -	Having tobacco in workings where safety-lamps are used.	Sp. Rule 55 -	„	0 5 6	0 10 6
„	26	Loader	„ „ „ -	Sp. Rule 55 -	„	0 5 6	0 10 6
„	26	Stallman -	„ „ „ -	Sp. Rule 55 -	„	0 5 6	0 10 6
„	26	„ -	„ „ „ -	Sp. Rule 55 -	„	0 9 6	0 10 6
„	26	Loader -	„ „ „ -	Sp. Rule 55 -	„	0 5 6	0 10 6
„	26	Header -	„ „ and matches	Sp. Rule 55 -	„	0 5 6	0 10 6
„	26	Stallman -	Having tobacco pipes where safety-lamps are used.	Sp. Rule 55 -	„	0 5 6	0 10 6
„	26	„ -	„ „ „ -	Sp. Rule 55 -	„	0 9 6	0 10 6
„	26	„ -	„ „ „ -	Sp. Rule 55 -	„	0 5 6	0 10 6
„	26	Holer -	„ „ „ -	Sp. Rule 55 -	„	0 5 6	0 10 6
June	24	Incline man	Riding on an underground road	Sp. Rule 78 -	„	0 10 6	0 10 6
„	24	Horse driver	„ „ „ -	Sp. Rule 78 -	„	0 10 6	0 10 6
„	26	Corporal -	Riding on the horse's back in the mine.	Sp. Rule 78 -	„	0 0 6	0 10 6
„	26	Horse driver	„ „ „ -	Sp. Rule 78 -	„	0 0 6	0 10 6
„	26	„ -	„ „ „ -	Sp. Rule 78 -	„	0 0 6	0 10 6
„	26	„ -	„ „ „ -	Sp. Rule 78 -	„	0 0 6	0 10 6
„	26	„ -	„ „ „ -	Sp. Rule 78 -	„	0 0 6	0 10 6
„	26	„ -	„ „ „ -	Sp. Rule 78 -	„	0 0 6	0 10 6
„	26	„ -	„ „ „ -	Sp. Rule 78 -	„	0 0 6	0 10 6
„	26	„ -	„ „ „ -	Sp. Rule 78 -	„	0 0 6	0 10 6
„	26	„ -	„ „ „ -	Sp. Rule 78 -	„	0 0 6	0 10 6
„	26	„ -	„ „ „ -	Sp. Rule 78 -	„	0 0 6	0 10 6
„	26	„ -	„ „ „ -	Sp. Rule 78 -	„	0 0 6	0 10 6
July	1	Stallman -	Removing brattice cloth, causing gas to accumulate.	Sp. Rule 5 -	„	Nil	0 14 0
„	22	Dataler -	Neglecting to attach a drag to a loaded tub.	Gen. Rule 36 -	„	1 0 0	0 14 0
„	22	„ -	„ „ „ -	Sp. Rule 36 -	„	1 0 0	0 14 0
„	25	Header -	Storing gunpowder in the mine	Sp. Rule 43 -	„	0 2 6	0 10 6
„	29	Dataler -	Smoking tobacco in the mine beyond a "fire" board.	Sp. Rule 55 -	„	1 0 6	0 19 6
Aug.	8	Stallman -	Having matches and pipe where safety-lamps are used.	Sp. Rule 63 -	„	0 1 0	0 10 6
„	8	„ -	„ „ „ -	Sp. Rule 63 -	„	0 10 0	0 10 6
Oct.	26	„ -	Passing a fence after a shot had missed fire.	Sp. Rule 51 -	„	Nil	0 10 0
Nov.	16	„ -	Leaving overhanging coal unspragged.	Sp. Rules 72 and 77.	„	0 5 0	0 9 6
Dec.	9	Holer -	Neglecting to set holing sprags	Sp. Rule 73 -	„	0 1 6	0 8 6
„	23	Stallman -	Firing a shot without first taking proper precautions.	Sp. Rule 47 -	„	1 10 0	0 16 6
„	23	„ -	Neglecting to set holing sprags	Sp. Rule 72 -	„	0 1 6	0 8 6
„	23	„ -	„ „ „ -	Sp. Rule 72 -	„	0 1 6	0 8 6
„	23	„ -	„ „ „ -	Sp. Rule 72 -	„	0 1 6	0 8 6
„	27	„ -	„ „ „ -	Sp. Rules 78 and 80.	„	1 0 0	0 10 6
„	27	Holer -	„ „ „ -	„ -	„	0 9 6	0 10 [illegible]

Mineral Statistics.

The statistics of mineral wrought and recorded in this report refer to mines under the Coal Mines Regulation Act. The quantity of minerals wrought from metalliferous mines will be found in my report upon the metalliferous mines of the district, and the statistics of mineral wrought from openworks will be found in the annual volume of Mineral Statistics for the year.

I have, &c.,
ARTHUR H. STOKES,
Her Majesty's Inspector of Mines.

The Right Hon. H. H. Asquith, M.P.,
Her Majesty's Principal Secretary of State,
Home Department, Whitehall, London.

Managers' and Under-Managers' Certificates.

The examination for certificates was held at Nottingham on the 26th, 27th, and 28th October, when 57 candidates presented themselves for examination, mostly persons engaged in mining in the district.

RETURN of the number of candidates who presented themselves at the several examinations, showing the number passed by the Examiners since the passing of the Mines Act, 1872.

Date of Examination.	Managers.		Under-Managers.	
	Number of Candidates.	Number passed.	Number of Candidates.	Number passed.
1873.—May 13th and 14th	30	20	—	—
1874.—January 8th and 9th	47	34	—	—
1874.—July 9th and 10th	23	4	—	—
1875.—January 13th and 14th	14	6	—	—
1875.—October 28th and 29th	26	12	—	—
1876.—October 24th and 25th	24	7	—	—
1877.—October 30th and 31st	13	5	—	—
1878.—October 30th and 31st	14	3	—	—
1879.—October 27th and 28th	16	9	—	—
1880.—October 21st and 22nd	11	4	—	—
1881.—October 27th and 28th	22	8	—	—
1882.—October 26th and 27th	13	7	—	—
1883.—October 25th and 26th	10	2	—	—
1884.—October 30th and 31st	13	4	—	—
1885.—October 29th and 30th	13	3	—	—
1886.—October 28th and 29th	21	7	—	—
1887.—October 27th and 28th	18	7	—	—
1888.—October 24th, 25th, and 26th	9	3	124	110
1889.—October 23rd, 24th, and 25th	8	3	70	52
1890.—October 30th, 31st, and November 1st	10	5	57	25
1891.—October 29th, 30th, and 31st	10	3	68	35
1892.—October 27th, 28th, and 29th	23	5	61	24
1893.—October 26th, 27th, and 28th	16	9	41	25
	404	170	421	271

The Board for the appointment of examiners meet at Nottingham once in each year. They appoint gentlemen of known experience and integrity to examine the several applicants for managers' and under-managers' certificates of competency. The subjects are arranged by the Board, leaving the separate questions for the examiners. The Secretary of State has directed that the examinations for this district shall be held in the month of October in each year.

Since the passing of the Mines Regulation Act of 1872 four hundred and four candidates have presented themselves, and one hundred and seventy were considered qualified and obtained official certificates of the first class. In the second class, four hundred and twenty-one have been up for examination, and two hundred and seventy-one obtained certificates as under-managers.

Board for the Appointment of Examiners.

The following gentlemen constitute the Board for the appointment of examiners:—

Colliery Owners	Charles Seely, Esq., Sherwood Lodge, Notts (Chairman). F. B. Wright, Esq., Wootton Court, Warwick. George Skey, Esq., Cleveland House, Great Malvern.
Mining Engineers, &c. &c.	J. A. Longden, Esq., Stanton-by-Dale, near Nottingham. J. P. Jackson, Esq., Clay Cross, Chesterfield. George Lewis, Esq., Derby.
Three persons not being Owners, Agents, &c. of mines.	Mr. Davies, Awsworth, Notts. Mr. Jacob Allen, Hartshill, Nuneaton. Mr. Chambers, Newthorpe, Notts.
Her Majesty's Inspector of Mines.	A. H. Stokes, Esq., Derby.

Board for Examinations for the Mining Districts of Derbyshire, Leicestershire, Nottinghamshire, and Warwickshire.

SIR, Wilson Street, Derby, 18 .

I AM directed by the Chairman of the Board for Examinations for these districts to inform you that the Secretary of State has been pleased to order the next examination of candidates for certificates of competency within the above districts to be held in the town of Nottingham, on the day of October next, and that such examination will be held accordingly at the University Buildings in Nottingham on that day, commencing at nine o'clock in the morning.

It will be necessary for you to present yourself punctually at the hour appointed.

The following gentlemen have been appointed examiners:—

Reuben Smallman, Esq., M.E., Nuneaton, Warwickshire.
S. C. Wardell, Esq., M.E., Doe Hill House, Alfreton.
W. H. Sankey, Esq., M.E., Morley, near Derby.

It is impossible to fix beforehand the length of time which the examination may occupy, but it is not probable that your attendance will be required for more than two days.

MANAGERS.

For First Class Certificates the subjects fixed for examination are the following:—

1. Writing. (Upon the Coal Mines Regulation Act, 1887, and the Special Rules of the District in which the candidate resides.)
2. Arithmetic.
3. The winning and working of mines of coal, mines of stratified ironstone, mines of shale, and mines of fire-clay.
4. Machinery.
5. Ventilation.
6. Safety of mines and miners; and opening works after having been closed for a period.
7. Surveying and plans.
8. The treatment of injured persons as recommended by the St. John Ambulance Association.

NOTE.—Candidates holding certificates from Government Science and Art Classes, or from the Nottingham University College, or from the St. John's Ambulance Association, should produce them to the examiners at the examination.

The candidates will be examined in reading, and will also be examined *vivâ voce* upon all the foregoing subjects.

Upon the question of the qualification of candidates for First Class Certificates, the Board for Examinations has passed the following Resolution:—"That, in their opinion, no "candidate shall be considered to have a practical experience in a Mine, for five years, "unless he has been for that time regularly engaged in connexion with actual Colliery "Management."

UNDER-MANAGERS.

For Second Class Certificates the subjects fixed for examination are the following :—

1. Writing. (Upon the Coal Mines Regulation Act, 1887, and the Special Rules of the District in which the candidate resides.)
2. Reading.
3. Arithmetic.
4. The use of the Anemometer, Barometer, and Water Gauge.
5. Ventilation, and the use of Safety-lamps.
6. The practical working of Mines (*vivâ voce* examination).
7. The treatment of injured persons as recommended by the St. John Ambulance Association.

NOTE.—Candidates holding certificates from Government Science and Art Classes, or from the Nottingham University College, or from the St. John's Ambulance Association, should produce them to the examiners at the examination.

General Instructions.

Persons who do not reside in the district are equally eligible for examination with those who do.

All candidates must be of the full age of 23 years. Section 23, sub-section (1), of the Coal Mines Regulation Act, 1887, provides that—

"No person shall be entitled to a Certificate under this Act unless he shall have had practical experience in a mine for at least five years."

Satisfactory evidence in the testimonials must be produced as to this.

Every candidate for examination for a certificate of competency will be required to sign an undertaking to keep the information contained in the examination papers strictly private and confidential, and also engage not to take a copy of any portion of such paper, or publish the same in any way.

If any candidate, at the time of examination, be found making use of books, memoranda, notes, copying, or obtaining information from other candidates, he will be disqualified, and his authorization for examination cancelled.

It will be necessary for you, before your examination can be proceeded with, to produce to the Examiners—

1. Your authorization from the Secretary of State to appear for examination.
2. A statement of the situations you have filled during the last five years, or longer period, to which a declaration must be appended that all the allegations are true; such declaration being signed by you in the presence of one witness, whose name and address must be given.
3. A certificate of sobriety and general good conduct, signed by either a clergyman, or other minister, or a magistrate; and also separate certificates from two respectable residents in his district, and whose addresses must be given.
4. A certificate of ability and experience from the employer, if any; or from two competent persons (mining engineers or others) acquainted with mining operations.

You must address your application for authority to appear before the Examiners, to Her Majesty's Principal Secretary of State for the Home Department, Whitehall, London, S.W. (See Form annexed.)

I am, Sir,
Your obedient Servant,
WILLIAM SAUNDERS,
Secretary.

Certificates of Competency.

The fee to be paid by an applicant for Examination is—

(1.) For a First Class Certificate of Competency, 2*l.*
(2.) For a Second Class Certificate of Competency, 1*l.*

Any person desirous of being examined must make an application to the Secretary of State, in the form hereunder set forth, enclosing therein a Post Office Order, or Postal Note, for the fee of 2*l.* or 1*l.*, as the case may be, in favour of Carey Knyvett, Esq., C.B., Home Office, Whitehall, London, S.W., made payable at the General Post Office, London. The applicant will then receive from the Home Office an authority to present himself for examination before the Examiners appointed for the District.

FORM OF APPLICATION FOR EXAMINATION.

Date ________________

Full Postal Address ________________

____

SIR,

I BEG to inform you that I am desirous of presenting myself to be examined by the Examiners for the district of for a (First or Second Class) Certificate of Competency as (Manager or Under-Manager) of a mine, and I enclose a Post Office Order for the sum of 2*l.* (or 1*l.*).

I am, Sir,
Your obedient Servant,

____

To The Right Hon. the Secretary
of State for the Home Department,
Whitehall, London, S.W.

To be accompanied by statement on paper of foolscap size :—

1. Name and address, in full, of applicant for (First or Second Class) Certificate.
2. Name of the District in which the applicant wishes to be examined

TABLE No. 2.

TABLE showing the ratios of separate FATAL ACCIDENTS and LIVES LOST to the Number of PERSONS EMPLOYED and MINERAL RAISED during the 38 years ended 31st December 1893.

Year.	Number of separate Fatal Accidents.	Number of Lives Lost.						Persons Employed.		Minerals raised in Statute Tons.	
		Explosions of Gas.	Falls of Roof and Side.	In Shafts.	Miscellaneous Underground.	Above-ground.	TOTAL.	Per Separate Fatal Accident.	Per Life Lost.	Per separate Fatal Accident.	Per Life Lost.
1856	42	3	21	16	3	3	46	—	—	107,143	97,826
1857	32	15	14	6	18	2	55	—	—	148,437	86,363
1858	33	—	16	12	13	1	42	—	—	153,333	120,476
1859	35	2	18	13	7	—	40	—	—	155,142	133,250
1860	40	3	21	13	11	2	50	—	—	155,125	124,300
1861	43	3	21	15	30	—	69	—	—	151,240	94,251
1862	42	2	25	4	11	1	43	—	—	158,262	154,581
1863	48	4	26	9	12	1	52	—	—	145,833	134,615
1864	64	11	30	9	14	2	66	415	403	114,063	110,606
1865	74	9	36	13	16	8	82	366	330	102,371	92,383
1866	55	7	26	5	13	7	58	493	467	138,182	131,034
1867	59	4	25	11	20	4	64	457	422	128,814	118,750
1868	58	1	24	9	22	4	60	483	466	132,741	128,317
1869	70	6	31	12	22	7	78	407	365	115,714	103,846
1870	47	2	22	6	16	4	50	613	576	178,000	167,320
1871	56	42	31	5	12	3	93	554	334	185,234	99,494
1872	74	7	38	8	20	6	79	531	497	144,015	134,900
1873	75	4	39	10	24	2	79	618	594	155,155	149,263
1874	52	3	26	6	21	2	58	953	903	227,727	215,948
1875	66	1	27	18	18	3	67	795	783	191,558	188,699
1876	66	6	46	8	13	4	77	793	679	189,394	162,338
1877	51	1	30	6	17	4	58	986	867	256,305	225,372
1878	49	—	31	11	8	5	55	1,007	897	277,047	246,824
1879	46	1	26	6	7	7	47	1,107	1,083	307,484	300,942
1880	56	—	35	5	11	8	59	881	836	261,130	247,852
1881	61	4	32	3	14	11	64	819	781	256,674	244,643
1882	61	70	34	6	24	4	138	818	361	257,411	113,783
1883	72	2	40	4	21	7	74	724	704	232,886	226,592
1884	55	1	31	4	11	8	55	969	969	294,511	294,511
1885	73	—	32	4	29	8	73	755	755	233,894	233,894
1886	56	2	33	8	11	9	63	985	876	300,969	267,528
1887	63	1	36	7	18	6	68	887	822	274,788	254,583
1888	60	—	38	4	12	7	61	966	949	303,361	298,388
1889	61	—	32	2	21	9	64	1,005	957	325,343	310,093
1890	64	—	32	8	17	8	65	1,039	1,022	322,809	317,856
1891	60	—	35	3	16	6	60	1,192	1,192	361,894	361,894
1892	69	—	42	8	16	7	73	1,082	1,022	314,871	297,618
1893	56	2	26	5	17	8	58	1,362	1,315	287,156	277,255

NOTE.—The mineral raised in the years 1856-1872 is coal only.

TABLE No. 3.

ACCIDENTS.

Summary of separate Colliery ACCIDENTS in the Midland District during the years 1873 to 1893.

	1873.	1874.	1875.	1876.	1877.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	1887.	1888.	1889.	1890.	1891.	1892.	1893.
Explosions of firedamp.	4	3	1	1	1	—	1	—	4	4	1	1	—	1	1	—	—	—	—	—	1
Falls of roof	37	23	26	41	29	29	26	32	30	34	40	31	32	31	34	37	31	31	35	40	26
Shafts	10	6	16	7	6	7	5	5	3	4	4	4	4	7	4	4	2	8	3	6	5
Miscellaneous	24	20	21	17	15	13	14	19	24	19	27	19	37	17	24	19	28	25	22	23	24
Total accidents	75	52	64	66	51	49	46	56	61	61	72	55	73	56	63	60	61	64	60	69	56

TABLE No. 4.

DEATHS.

Summary of DEATHS caused by accidents in the Midland District during the years 1873 to 1893.

Year.		Falls in the Mine.			In Shafts.									Miscellaneous Underground.							On Surface.					
	Explosions of Firedamp.	Falls of Side.	Falls of Roof.	TOTAL FALLS in the MINE.	Over-winding.	Ropes and Chains breaking.	Whilst ascending or descending by Machinery.	Falling into Shaft from Surface.	Things falling from Surface.	Falling from part way down.	Things falling from part way down.	Miscellaneous in Shafts.	TOTAL in SHAFTS.	Explosions of Gunpowder, &c.	Suffocation by Gases.	On Incline and Engine Planes.	By Trams and Tubs.	By Machinery Underground.	Sundries Underground.	TOTAL { MISCELLANEOUS UNDERGROUND.	By Machinery on Surface.	Boilers bursting.	Railway Sidings at the Mine.	Miscellaneous Surface.	TOTAL on SURFACE.	GROSS TOTAL.
1873	4	6	33	39	—	—	4	3	1	1	—	1	10	—	2	9	9	—	4	24	1	—	—	1	2	79
1874	3	5	21	26	—	2	2	—	—	2	—	—	6	2	3	6	8	1	1	21	2	—	—	—	2	58
1875	1	8	19	27	—	—	1	3	2	4	2	6	18	2	—	1	11	—	4	18	2	—	—	1	3	67
1876	6	13	33	46	2	—	3	1	—	1	1	—	8	2	—	4	7	—	—	13	3	—	—	1	4	77
1877	1	12	18	30	—	1	2	—	—	—	3	—	6	1	7	—	6	1	2	17	1	—	—	3	4	58
1878	—	11	20	31	—	1	1	1	—	—	6	2	11	1	—	2	5	—	—	8	2	—	—	3	5	55
1879	1	7	19	26	—	—	—	—	1	5	—	—	6	2	—	1	3	—	1	7	4	1	—	2	7	47
1880	—	8	27	35	—	—	1	—	2	—	—	2	5	1	—	5	4	1	—	11	1	—	—	7	8	59
1881	4	9	23	32	—	—	—	1	1	—	—	1	3	2	2	4	5	—	1	14	3	—	—	8	11	64
1882	70	9	25	34	—	1	3	—	—	—	—	2	6	2	9	5	7	—	1	24	1	—	—	3	4	138
1883	2	7	33	40	—	—	1	—	—	2	—	1	4	5	—	9	6	1	—	21	—	—	—	7	7	74
1884	1	8	23	31	1	—	—	—	—	2	—	1	4	1	1	—	9	—	—	11	3	—	—	5	8	55
1885	—	7	25	32	—	—	—	—	2	1	—	1	4	1	—	8	16	1	3	29	3	—	—	5	8	73
1886	2	14	19	33	1	1	2	—	—	3	1	—	8	—	4	3	3	—	1	11	3	—	—	6	9	63
1887	1	10	26	36	4	—	—	—	1	2	—	—	7	1	—	6	7	1	3	18	1	—	—	5	6	68
1888	—	9	29	38	—	—	—	2	—	1	—	1	4	—	—	2	7	1	2	12	4	—	—	3	7	61
1889	—	14	18	32	—	—	2	—	—	—	—	—	2	1	1	9	6	1	3	21	—	—	8	1	9	64
1890	[illegible]	7	25	32	—	—	—	3	—	—	1	4	8	1	—	2	11	—	3	17	2	—	3	3	8	65
1891	—	7	28	35	—	1	2	—	—	—	—	—	3	1	—	2	10	—	3	16	—	—	5	1	6	60
1892	—	6	36	42	—	3	—	1	—	2	1	1	8	1	—	7	7	—	1	16	2	—	2	3	7	73
1893	2	13	13	26	—	1	1	—	—	—	1	2	5	2	2	4	3	—	6	17	3	—	4	1	8	58

TABLE No. 5.

PERSONS EMPLOYED and MINERAL WROUGHT in the Midland District comprising the Counties of Derby, Leicester, Nottingham, and Warwick during the years 1873 to 1893.

Year.	Number of PERSONS EMPLOYED.			Quantity of MINERAL RAISED in Statute Tons.				
	Under-ground.	Above-ground.	TOTAL.	Coal.	Fire-clay.	Ironstone.	Shale and other Minerals.	TOTAL.
1873	36,544	10,430	46,974	11,533,407	29,860	228,520	—	11,791,787
1874	40,673	11,706	52,379	12,232,296	73,163	219,545	—	12,525,004
1875	40,789	11,688	52,477	12,430,600	61,469	150,700	84	12,642,853
1876	40,260	12,088	52,348	12,331,546	47,066	121,379	1,063	12,501,054
1877	38,788	11,497	50,285	12,903,886	61,779	103,551	2,350	13,071,566
1878	38,170	11,184	49,354	13,440,184	55,508	74,926	4,702	13,575,320
1879	39,222	11,701	50,923	14,036,242	64,227	40,127	3,669	14,144,265
1880	37,960	11,370	49,330	14,500,995	66,589	51,197	4,479	14,623,260
1881	38,365	11,614	49,979	15,545,667	61,543	47,137	2,801	15,657,148
1882	38,435	11,464	49,899	15,566,324	79,157	51,728	4,875	15,702,084
1883	40,310	11,808	52,118	16,637,304	77,258	48,242	4,993	16,767,797
1884	41,410	11,868	53,278	16,080,682	77,630	36,097	3,722	16,198,131
1885	42,989	12,174	55,163	16,963,684	77,122	29,386	4,051	17,074,243
1886	43,164	12,012	55,176	16,760,227	76,992	13,264	3,829	16,854,312
1887	43,594	12,304	55,898	17,214,907	85,089	7,758	3,892	17,311,646
1888	45,491	12,444	57,935	18,095,240	86,022	16,803	3,620	18,201,685
1889	48,305	12,974	61,279	19,712,868	107,969	21,404	3,701	19,845,942
1890	53,137	13,331	66,468	20,518,034	111,588	26,501	3,713	20,659,836
1891	57,056	14,484	71,540	21,569,151	117,456	22,425	4,659	21,713,691
1892	59,655	15,002	74,657	21,587,967	119,383	14,363	4,409	21,726,122
1893	61,139	15,133	76,272	15,951,572	115,615	9,094	4,496	16,080,777

TABLE No. 5A.

SUMMARY of NON-FATAL ACCIDENTS reported under the Coal Mines Regulation Act during the year 1893.

County.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Derbyshire - - -	36	25	43	20	28	25	31	7	1	12	17	41	286
Leicestershire - - -	2	2	0	2	4	3	2	0	2	2	7	8	35
Nottinghamshire - - -	15	13	13	10	8	14	14	0	0	10	18	23	138
Warwickshire - - -	7	5	5	3	2	8	7	1	0	5	4	4	51
	61	45	61	35	42	50	54	8	3	29	46	76	510

TABLE No. 6.

TOTAL Number of DEATHS in the different COLLIERIES in the years 1865 to 1893.

Name of Colliery.	Owner's Name.	Total Deaths in 29 years.
Clay Cross	Clay Cross Iron and Coal Company	139
Staveley	Staveley Iron and Coal Company	120
Butterley	Butterley Iron and Coal Company	107
Renishaw Park	J. and G. Wells, Limited	74
Eastwood, High Park, &c.	Barber, Walker, & Co.	72
Sheepbridge, Norwood, Langwith, &c.	Sheepbridge Iron and Coal Company	65
Birley Vale	Sheffield Coal Company	53
Cinderhill, Newcastle, &c.	Babbington Coal Company	50
Teversall, Pleasley, and Silver Hill	Stanton Iron Company	48
Baddesley	W. S. Dugdale's Trustees	44
Tibshelf and Birchwood	Babbington Coal Company	37
Grassmoor	Barnes Brothers	37
Bretby and Newhall Park	Earl of Carnarvon	35
Whitwick and Ibstock	Whitwick and Ibstock Colliery Companies	34
Riddings	James Oakes & Co.	32
Stanton	J. and N. Nadin & Co.	28
Moira, &c.	Lord Donington	27
Swannington and Coleorton	Walker and Worswick	26
Albert	Derbyshire Silkstone Colliery Company	26
Pilsley	Pilsley Colliery Company	25
Blackwell	Blackwell Colliery Company	25
Hall End and Birch Coppice	Morris & Shaw	24
Annesley	Annesley Colliery Company	24
Hucknall Torkard	Hucknall Torkard Colliery Company	21
Shireoaks and Steetly	Shireoaks Colliery Company	20
Pinxton	Coke & Co.	19
Shipley	E. M. Mundy	19
Bedworth Charity	Bedworth Coal Company	18
Swadlincote and Cadley Hill	Hall and Boardman	17
Wollaton	Wollaton Coal Company	17
Amington and Glascote	Firmstone & Co.	17
Manners	Manners Colliery Company	17
Shirland	Blackwell Colliery Company	16
Kilburn	Kilburn Colliery Company	16
Bestwood	Bestwood Iron and Coal Company	16
Netherseal	Netherseal Coal Company	16
New Hucknall	New Hucknall Colliery Company	16
Clifton	Clifton Colliery Company	15
Snibston	South Leicestershire Colliery Company	15
Coton Park	Coton Park Colliery Company	14
Cossall	Cossall Colliery Company	14
Boythorpe	Boythorpe Colliery Company	13
Griff	Griff Colliery Company	13
Granville	Granville Colliery Company	13
Swanwick	C. R. P. Morewood	12
Wingerworth	Wingerworth Coal Company	12
Wyken	Wyken Colliery Company	12
Digby	Digby Colliery Company	12
Ellistown	J. J. Ellis' Trustees	11
Donisthorpe	Checkland and Williams	11
Haunch Wood	Sir Alfred Hickman	11
Southgate	Shireoaks Colliery Company	10
Renishaw	J. and G. Wells, Limited	10
Unstone	Unstone Coal and Coke Company	10
Mapperley	Mapperley Colliery Company	10
West Hallam	West Hallam Colliery Company	10
Alma	T. Holdsworth	9
Skegby	Skegby Colliery Company	9
Newstead	Newstead Colliery Company	9
Denby	W. D. Lowe	9
Oakwell	Ilkeston Colliery Company	8
Linby	Linby Coal Company	8
Cottam	Renishaw Iron Company	8
Holmewood	Hardwick Coal Company	7
Exhall	E. Wilson	7
Denby and Ryefield	Denby Iron Company	7
South Leicestershire	South Leicestershire Colliery Company	7
Staunton Harold	Staunton Colliery Company	7
Pooley Hall	Pooley Hall Colliery Company	6
Axedge and Thatchmarsh	Buxton Lime Company	6
Awsworth	Awsworth Colliery Company	6

Name of Colliery.	Owner's Name.	Total Deaths in 29 years.
Bolsover	Bolsover Colliery Company	6
Nuneaton	Nuneaton Colliery Company	6
Alvecote	Tamworth Colliery Company	6
Stockingford	Stockingford Colliery Company	5
Nailstone	F. Hall's, Trustees	5
Tibshelf and Blackwell	E. Chambers	5
Plumbley	J. and G. Wells, Limited	5
Old Swadlincote	Newhall Colliery Company	5
Craven, Coventry	W. S. & J. Harris	4
Coleorton	Checkland & Co.	4
Aspenshaw	Aspenshaw Coal Company	4
Ansley Hall	Ansley Hall Coal Company	4
Bagworth	Bagworth Coal Company	3
Birchvale and Thornsett	Thomas Bennett	3
Tame Valley	G. Skey & Co.	3
Marehay	Marehay Colliery Company (Fords)	3
Hockley Hall and Whateley	Hockley Hall Colliery Company	2
Pentrich	W. C. Haslam	2
Stanley Kilburn	Stanley Kilburn Colliery Company	2
Wilnecote Works	Geo. Skey & Co.	2
Trowell Moor	Dunn Brothers	2
Stoneyford and Pollington	James Oakes & Co.	2
Burned Edge and Bugsworth	L. & E. Hall	2
Dale	Stanton Iron Company	1
Peacock	Peacock Colliery Company	1
Heather	Heather Colliery Company	1
Brockwell	C. J. Saunders	1
Lodge	W. Hall	1
Streetfield	W. Worrall	1
Highfield	Theo. Pearson	1
Chisworth	Abel Clayton	1
Owl Cotes	Wingerworth Coal Company	1
St. John's, Staveley	Staveley Silkstone Company	1
Walton	James Pearson	1
Diminsdale	Diminsdale Colliery Company	1

TABLE No. 7.

LIST of UNDERGROUND COLLIERY EXPLOSIONS in the MIDLAND DISTRICT during the Year 1893.

Date.	Name of Colliery.	Name of Seam.	No. of Persons injured. Non-Fatal.	Fatal.	Height of Barometer at Time of Explosion reduced to Sea Level.	Remarks.
1893. Feb. 6	Teversal - -	Top hard -	1	—	30·40 S	The stallman had fired a shot in the coal, and was preparing to cut the coal through to the back of the holing, when he fired a small quantity of gas which had accumulated.
„ 9	Salterwood -	Tupton - -	1	—	29·90 F	As the man was proceeding to his working place, he raised a piece of clay up to the wet roof to moisten it, and at the same time held a lighted candle in his hand, which ignited a a small quantity of gas.
„ 11	Whitwick, No. 6	Roaster - -	—	2	29·65 S	Fall of roof in the main roadway liberated a quantity of gas that had accumulated over the timber. The gas fired at the two naked lights of the pony drivers, who were passing within a few yards of the roadway at the time. (See special report, p. 6.)
Mar. 25	Wyken - -	Slate - -	1	—	30·45 R	He was slightly burnt whilst taking some bars out at the top of an incline roadway.
Apr. 18	Alvecote - -	Seven Feet -	—	—	30·20 F	Two youths ignited a very small quantity of gas which had issued through a stopping built to put out a gob-fire. No one was injured.
May 16	Tibshelf - -	Deep Hard -	2	—	30·05 F	Gas had accumulated at a gate-end lip owing to the ventilation doors having been negligently left open. The stallman and loader came to the gate-end, and the gas fired at the naked lights they were carrying.
Oct. 18	Manners - -	Kilburn - -	2	—	30·25 R	One man went up to examine a hole in the roof from which a large quantity of stone had fallen, and ignited some gas. The other man was watching him, and was injured by the flame.
Dec. 7	Blackwell B. Winning.	Deep Hard -	1	—	29·90 R	A small quantity of gas fired at the gate-end lip, owing to a cloth being knocked down in the stall by a fall of roof.
	Total deaths by explosions -		—	2		
	Total injured by explosions -		8	—		

NOTE.—R indicates rising; S steady; and F falling Barometer.

3 explosions of gas—Rising barometer.
2 „ „ Steady „
3 „ „ Falling „

TABLE No. 8.

List of Accidents from Explosives in the Midland District during the Year 1893.

Date.	Name of Colliery.	No. of Persons injured. Non-Fatal.	Fatal.	Remarks.
1893. Jan. 18	Whitwell - - - -	1	—	A deputy was taken seriously ill about half-an-hour after examining the face of a heading after firing a roburite shot, and showed symptoms of having been poisoned by the fumes.
Feb. 23	Riddings, Alfreton - - -	—	1	Deceased was firing a shot in the gate ripping, and did not go far enough away. Some pieces of rock were blown down the gate and hit deceased.
June 22	Wollaton - - - -	1	—	A stallman was attaching a fuse to a cartridge of powder, when a spark fell from his lighted candle on to the powder, causing it to explode.
" 22	Hall End - - - -	2	—	The stallman was ramming the powder in a shot hole when it exploded, owing, probably, to some hard material in the tamping.
July 13	Hornthorpe - - - -	1	—	A piece of coal was blown from the shot he had just fired, and hit the deputy, who did not retire far enough away from the shot hole.
Oct. 23	South Leicestershire - - -	1	—	The manager was passing through a working place when a shot went off and injured him. The stallman had neglected to send a man in each direction to prevent persons approaching the place where the shot had to be fired.
Dec. 8	Bestwood - - - -	1	—	The deputy unnecessarily exposed himself when he was firing a shot with a cable and battery. Some pieces of rock struck him.
" 22	Tunnel, Haunchwood - -	1	—	The stallman was greasing a powder cartridge with a lighted candle to make it watertight, and lighted the same.
" 29	Reservoir, Moira - - -	—	1	The deputy was firing a shot by using a "german," and the shot appears to have fired directly he lighted the end of the "german."
	Total deaths by explosives -	—	2	
	Total injured by explosives -	8	—	

TABLE No. 9.

LIST of MISCELLANEOUS EXPLOSIONS in the MIDLAND DISTRICT during the Year 1893.

Date.	Name of Colliery.	No. of Persons injured. Non-Fatal.	No. of Persons injured. Fatal.	Remarks.
1893. Mar. 23	Newhall Park - - -	1	—	The stoker was pushing the unconsumed slack from the front to the back of a boiler fire when some gas fired and burnt him.
July 14	Woodside, Shipley - - -	2	—	After charging a shot hole with lime cartridges, the front of the coal fell off, which caused a quantity of lime dust to fall from the hole, some of which injured the eyes of two stallmen.
Dec. 11	Bedworth - - - -	1	—	He was trimming a torch lamp burning petroleum when it exploded.
,, 28	Manners - - - -	1	—	The lamp repairer was about to make some repairs to a tin bottle that had contained paraffin, and foolishly placed it on the fire, afterwards placing a lighted match to the neck of the bottle, when it exploded.
	Total deaths by miscellaneous explosions	—	—	
	Total injured by miscellaneous explosions.	5	—	

APPENDIX I.

SUMMARY of PERSONS EMPLOYED in and about the MINES, and TONS of MINING PRODUCE, in the MIDLAND DISTRICT, during the Year 1893 (excluding those employed on Private Branch Railways and in Washing and Coking Coal).

NAMES OF COUNTIES.	Underground.			Aboveground—Ages.							Total above and below ground.	Coal.	Fire-clay	Ironstone.	Pyrites.	Mineral Oil.
	Male Persons—Ages.			12 to 13.		13 to 16.		Above 16.		Total.						
	12 to 16.	Above 16.	Total.	Boys.	Girls.	Boys.	Girls.	Females.	Males.							
Derbyshire - - - -	2,969	29,745	32,714	7	–	696	–	–	6,966	7,669	40,383	7,882,779	37,756	8,545	878	—
Leicestershire - - - -	319	4,570	4,889	4	–	161	–	–	1,324	1,489	6,378	1,203,961	37,230	—	—	—
Nottinghamshire - - - -	1,624	17,052	18,676	6	–	305	–	–	4,134	4,445	23,121	5,328,838	1,373	—	185	—
Warwickshire - - - -	231	4,629	4,860	–	–	131	–	–	1,399	1,530	6,390	1,535,994	39,256	549	3,433	—
TOTAL - -	5,143	55,996	61,139	17	–	1,293	–	–	13,823	15,133	76,272	15,951,572	115,615	9,094	4,496	—

APPENDIX II.

LIST of the FATAL ACCIDENTS, and DEATHS arising therefrom, within one year and a day from the date of the Accident, in the MIDLAND DISTRICT during the Year 1893.

No. of Accidents.	Date and Hour of the Accident.	Hour of the Person's Shift, i.e., No. of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Firedamp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Aboveground.	Total.
1	1892. July 7 8.30 a.m.	4th	Snibston (No.3)	Coalville (Leicestershire).	South Leicestershire Colliery Co.	William Glover -	35	Header -	Fall of roof. A fall of roof occurred in the heading in which he was working. Died 25th March 1893.	–	1	–	–	–	1
2	1893. Jan. 6 12.0 noon	5th	Brinsley (Soft Coal).	Eastwood (Notts)	Barber, Walker, & Co.	Charles Ford Pollard	31	Stallman -	Fall of coal. Deceased had been called away from the place where he was working, and upon his return some coal fell upon him.	–	1	–	–	–	1
3	Jan. 12 10.40 a.m.	5th	Renishaw Park (No. 2.)	Eckington (Derbyshire).	J. & G. Wells, Limited	Felix Henry Butler	14	Horse driver	Found dead in front of the first full tub of a train of five which he was taking along a roadway. No evidence to show whether he fell whilst walking in front of his horse, or that he was riding on the shafts and fell off.	–	–	–	1	–	1
4	Jan. 24 1.0 p.m.	6th	Amington -	Tamworth (Warwickshire).	Glascote Colliery Co. -	Arthur Hunt -	29	Stallman -	Fall of roof. Deceased was removing some coal, preparatory to getting the roof down, when it unexpectedly fell upon him. Died on 28th.	–	1	–	–	–	1
5	Jan. 25 11.[illegible]0 p.m.	1st	Amington -	Tamworth (Warwickshire).	Glascote Colliery Co. -	Alfred Edgar Donovan.	19	Horse driver	Deceased appears to have been riding on the sling-gears of a horse, and in passing through a door was jammed between the door side and the full tub. Had "limmers" or shafts been used it is probable that this accident would not have occurred.	–	–	–	1	–	1

List of Fatal Accidents—*continued*.

No. of Accidents.	Date and Hour of the Accident.	Hour of the Person's shift, i.e., No. of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Firedamp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Aboveground.	Total.
6	1893. Jan. 26 11.30a.m.	6th	Craven - -	Coventry (Warwickshire).	W. S. and J. Harris -	Walter Prescott -	22	Browman -	Deceased went down the landing at the top of the incline in front of 10 full tubs, which overpowered and ran over him. Died same day.	–	–	–	1	–	1
7	Jan. 26 9.30p.m.	1st	Grassmoor No.1 (Tupton Coal).	Chesterfield (Derbyshire).	Grassmoor Colliery Co.	Henry Ensor -	32	Dataler -	Was kicked on the head by a horse. Died on 30th instant.	–	–	–	1	–	1
8	Jan. 28 6.0 a.m.	9th	Bulwell - -	Nottingham (Notts).	Babbington Coal Co. -	Frederick Johnson	65	Rope greaser	Deceased appears to have been stepping across a moving haulage rope, when it threw him down. Died 2nd February.	–	–	–	1	–	1
9	Jan. 30 8.30 a.m.	2nd	Hartington -	Staveley (Derbyshire).	Staveley Coal and Iron Co.	Thomas Turner -	29	Stallman -	Fall of roof. He was repairing the gate-end when some roof fell upon him. He died suddenly on the 1st February.	–	1	–	–	–	1
10	Feb. 2 10.30a.m.	4th	New Hucknall	Mansfield (Notts).	New Hucknall Colliery Co.	Henry Riley -	47	Do. -	Fall of coal. Appears to have been taking out holing sprags to get the coal down.	–	1	–	–	–	1
11	Feb. 6 7.0 a.m.	1st	Marehay Main (Tupton Coal).	Ripley (Derbyshire).	C. Ford -	Samuel Bowner -	47	Do. -	Fall of roof. Deceased was attempting to withdraw a back prop by cutting it out with a pick, when a large piece of roof fell upon him. He should have used a ringer and chain, in accordance with the special rules of the mine.	–	1	–	–	–	1

List of Fatal Accidents—*continued.*

No. of Accidents.	Date and Hour of the Accident.	Hour of the Person's Shift, i.e., No. of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Firedamp.	Lives lost. Falls of Roof and Sides.	Lives lost. In Shafts.	Lives lost. Miscellaneous Underground.	Lives lost. Aboveground.	Lives lost. Total.
12	1893. Feb. 7 2.0 p.m.	7th	Albert -	Chesterfield (Derbyshire).	Derbyshire Silkstone Coal Co.	Henry Sankey -	43	Stallman -	Fall of coal. Deceased was working under overhanging top coal which had been left unspragged, and contrary to the special rules of the mine. The top coal fell upon him.	–	1	–	–	–	1
13	Feb. 10 7.15a.m.	2nd	Swannington (Main Coal).	Ashby-de-la-Zouch (Leicestershire).	Cox and Turner -	Henry Upton -	15	Horse driver	Deceased was taking a pony with one full tub, and must have been driving furiously, as when he came to a turn in the road the tub got off the metals and knocked some timber out, which liberated the roof, and fell upon him.	–	1	–	–	–	1
14	Feb. 11 11.15a.m.	5th	Whitwick (No.6)	Coalville (Leicestershire).	Whitwick Colliery Co.	Peveril Commons - Alfred Thomas Gardner.	17 16	Do. - Do. -	Explosion of gas. Fall of roof in the main roadway of the mine, which liberated a quantity of gas that had accumulated over the timber. The gas fired at the two naked lights of the pony drivers, who were passing within a few yards of the roadway at the time. (*See* p. 6.)	1 1	– –	– –	– –	– –	1 1
15	Feb. 13 1.0 p.m.	6th	High Park -	Eastwood (Notts).	Barber, Walker & Co.	William Varley -	28	Stallman -	Fall of roof. Deceased was holing the coal on the top, or "bannocking," when a sprag was knocked out, liberating the roof, which fell and killed deceased.	–	1	–	–	–	1

List of Fatal Accidents—*continued.*

No. of Accidents.	Date and Hour of the Accident.	Hour of the Person's Shift, i.e., No. of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Firedamp.	Lives lost. Falls of Roof and Sides.	Lives lost. In Shafts.	Lives lost. Miscellaneous Underground.	Lives lost. Aboveground.	Lives lost. Total.
16	1893. Feb. 13 1.0. p.m	7th	Awsworth -	Ilkeston (Notts)	Awsworth Colliery Co.	William Farnsworth	42	Screenman	Crushed by the spokes of a fly-wheel which moved whilst the deceased stood near it, watching the engine-man do some repairs.	–	–	–	–	1	1
17	Feb. 13 2.0 p.m.	7th	Diminsdale (Top Hard Coal).	Alfreton (Derbyshire).	Diminsdale Colliery Co.	Job Hardy - -	42	Stallman -	Fall of roof. The deceased was driving a heading, when a large quantity of roof fell.	–	1	–	–	–	1
18	Feb. 13 7.0 p.m.	4th	Glapwell -	Chesterfield (Derbyshire).	Sheepbridge Coal and Iron Co.	William Evans -	45	Dataler -	Fall of roof. Deceased was in charge, repairing a roadway, and had taken one bar out, when a large fall of roof took place, driving out two other bars.	–	1	–	–	–	1
19	Feb. 23 8.0 a.m.	2nd	Pye Hill (Low Main Coal).	Riddings Alfreton (Notts).	James Oakes & Co. -	Thomas Fletcher -	58	Deputy -	Deceased was firing a shot in the gate ripping, and did not go far enough away. Some pieces of rock were blown down the gate and hit the deceased. Died on 25th instant.	–	–	–	1	–	1
20	Feb. 25 2.0 p.m.	9th	Cottam - -	Chesterfield (Derbyshire).	Appleby & Co. -	Alfred Revitt -	43	Pumping engine-man.	Deceased was engaged repairing some steam pipes in the mine, when, through some misunderstanding with regard to the signals, the steam was turned on, and deceased was fatally scalded. He died on 27th February.	–	–	–	1	–	1

List of Fatal Accidents—*continued.*

No. of Accidents.	Date and Hour of the Accident.	Hour of the Person's Shift, i.e., No. of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Firedamp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Aboveground.	Total.
21	1893. Feb. 27 8.55 a.m.	3rd	Grassmoor, No.1 (Tupton Coal).	Chesterfield (Derbyshire).	Grassmoor Colliery Co.	Emblem Pell -	30	Stallman -	Fall of coal. Deceased was cutting the top coal through when a sudden weight came on and knocked out the timber	–	1	–	–	–	1
22	Feb. 28 10.15a.m.	4th	New Hucknall (DeepHard Coal).	Mansfield (Notts).	New Hucknall Colliery Co.	Edward Blood -	31	Deputy -	A horse appears to have run away near the pit bottom, and deceased in following it crossed the pit bottom under the descending cage, which crushed him. He died the same day.	–	–	1	–	–	1
23	Feb. 28 3.0 p.m.	8th	West Hallam - (KilburneCoal).	Ilkeston (Derbyshire).	West Hallam Colliery Co.	Isaac Keightley -	15	Horse driver	Deceased was walking in front of his horse and loaded tubs, when the horse stepped on him, and threw him down in the roadway. Died 2nd March.	–	–	–	1	–	1
24	Apr. 10 2.30a.m.	9th	Whitwell -	Chesterfield (Derbyshire).	Shire Oaks Colliery Co.	William Dolby -	45	Deputy -	Deceased was riding down an incline roadway on some water barrels, and was crushed between the tubs and the roof. Died 12th instant.	–	–	–	1	–	1
25	Apr. 11 11.0a.m.	5th	Birley (West Pit).	Sheffield (Derbyshire).	Sheffield Coal Co. -	Joseph Potts -	25	Banksman -	Deceased was attempting to put a leather belt on a revolving pulley, when his coat caught in the machinery, and he was pulled round the shaft and killed before the machinery was stopped.	–	–	–	–	1	1

List of Fatal Accidents—*continued.*

No. of Accidents.	Date and Hour of the Accident.	Hour of the Person's Shift, i.e., No. of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Firedamp.	Lives lost. Falls of Roof and Sides.	Lives lost. In Shafts.	Lives lost. Miscellaneous Underground.	Lives lost. Aboveground.	Lives lost. Total.
26	1893. Apr. 13 1.0 p.m.	7th	Pye Hill (Low Main Coal).	Riddings Alfreton (Notts).	James Oakes & Co. -	Arthur Bonsall -	17	Loader -	Fall of coal. Deceased was holing, when a piece of coal fell from between the sprags and killed him.	–	1	–	–	–	1
27	Apr. 20 5.0 p.m.	10th	Butterley Park	Alfreton (Derbyshire).	Butterley Co. - -	William Langton -	62	Assistant enginewright.	Deceased had been attending to some repairs to a pumping engine, and when it was started the beam knocked down a ladder on which he was standing, throwing him to the ground. Died next day.	–	–	–	–	1	1
28	Apr. 20 8.30 p.m.	9th	Bedworth Charity.	Coventry (Warwickshire).	Bedworth Coal and Iron Co.	William Harrold -	43	Stallman -	Fall of coal. Deceased was preparing the front of the coal before commencing to hole, when a quantity of coal fell off and struck him. Died 30th instant.	–	1	–	–	–	1
29	Apr. 29 9.0 a.m.	3rd	Bolsover -	Chesterfield (Derbyshire).	Bolsover Colliery Co. -	Alfred Wood -	34	Ditto -	Fall of roof whilst engaged building a pack. Died 8th May.	–	1	–	–	–	1
30	May 3 9.0 a.m.	3rd	Manners -	Ilkeston (Derbyshire).	Manners Colliery Co. -	George Lawrence Kirk.	15	Rope-runner	Deceased fell down on the roadway. The injury was very slight, but an abscess subsequently formed on his thigh. Died 19th May.	–	–	–	1	–	1
31	May 4 4.0 p.m.	10th	Newhall Field -	Swadlincote (Derbyshire).	Newhall Field Colliery Co.	Louis Whitehall -	27	Stallman -	A lever working the signal wire fell down the shaft, and struck deceased as he was entering the cage at the pit bottom. Died 9th May.	–	–	1	–	–	1

List of Fatal Accidents—*continued.*

No. of Accidents.	Date and Hour of the Accident.	Hour of the Person's Shift, i.e., No. of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Firedamp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Aboveground.	Total.
32	1893. May 10 9.30a.m.	4th	Exhall - -	Coventry (Warwickshire).	Edward Wilson -	James Bird Masser	35	Banksman -	Crushed between a railway waggon and the post of a screen.	–	–	–	–	1	1
33	June 2 11.30a.m.	6th	Shire Oaks -	Worksop(Notts)	Shire Oaks Colliery Co.	George Mitchell -	57	Labourer -	Crushed between the buffers of two railway waggons whilst lowering one under the screens. Died 4th instant.	–	–	–	–	1	1
34	June 12 12. 5a.m.	2nd	Manners -	Ilkeston (Derbyshire).	Manners Colliery Co. -	David Tatham - James Tatham -	62 15	Dataler - Ditto -	Both were engaged in sealing up a fire in the mine, and were suffocated by noxious gas issuing through a stopping which they were endeavouring to seal up.	–	–	–	1 1	–	1 1
35	June 29 8.0 a.m.	2nd	Denby - -	Derby (Derbyshire).	W. Drury-Lowe -	George Green -	17	Horse driver	Crushed against a door by the horse he was driving, as he was unable to open it for the horse to pass through.	–	–	–	1	–	1
36	July 19 11.30a.m.	5th	Church Gresley	Burton-on-Trent (Derbyshire).	Moria Colliery Co. -	William Wilton -	68	Banksman -	Was crushed between two railway waggons whilst removing one from under the screens. Died 25 July.	–	–	–	–	1	1
37	July 25 11.30a.m.	6th	Clay Cross, No. 2 Pit.	Chesterfield (Derbyshire).	Clay Cross Co. - -	Frank Smedley -	52	Stallman -	Fall of roof whilst passing under the gate-end, where shortly before a prop had been taken out to make room for the tubs to pass.	–	1	–	–	–	1
38	July 25 2.30 p.m.	8th	Pleasley -	Mansfield (Notts)	Stanton Iron Co. -	William Donaldson	59	Holer -	Fall of coal. Whilst deceased was holing a piece of coal fell upon him from between two sprags. He died on 6th September.	–	1	–	–	–	1

List of Fatal Accidents—*continued.*

No. of Accidents.	Date and Hour of the Accident.	Hour of the Person's Shift, *i.e.*, No. of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Firedamp.	Lives lost. Falls of Roof and Sides.	Lives lost. In Shafts.	Lives lost. Miscellaneous Underground.	Lives lost. Aboveground.	Lives lost. Total.
39	1893. July 28 12.15p.m.	6th	West Hallam, No. 4 Pit (Deep Soft Coal).	Ilkeston (Derbyshire).	West Hallam Colliery Co.	Aaron Bancroft -	35	Roadman -	Full tub broke away in a self-acting incline, due to improper coupling of the under chain. Had the coupling of the under chain been properly attached the accident would not have occurred.	–	–	–	1	–	1
40	Sept. 5 6.5 a.m.	1st	Tibshelf (No. 3)	Alfreton (Derbyshire).	Babbington Coal Co.	John Fletcher -	47	Pit sinker -	He was descending the shaft in a tub, when the tub caught a scaffold in the shaft, and deceased was thrown out and fell to the bottom.	–	–	1	–	–	1
41	Oct. 18 11.30a.m.	6th	Granville -	Burton-on-Trent (Derbyshire).	Granville Colliery Co.	Thomas Spencer -	50	Ditto -	Deceased was sinking a water shaft to supply the colliery, and whilst a tub of dirt was being brought to the surface the hemp rope broke, and the tub fell upon the deceased.	–	–	1	–	–	1
42	Oct. 21 8.30 a.m.	3rd	Pleasley -	Mansfield (Notts)	Stanton Iron Co. -	Charles Frederick Graves.	24	Shunter -	He went between two railway waggons to uncouple them instead of using the shunting pole, when the engine driver moved the waggons before deceased was clear of the rails. Deceased had a foot fast in the points or would probably have been out from between the waggons. He died the same day.	–	–	–	–	1	1

List of Fatal Accidents—*continued.*

No. of Accidents.	Date and Hour of the Accident.	Hour of the Person's Shift, i.e., No. of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Firedamp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Aboveground.	Total.
43	1893. Oct. 26 8.5 a.m.	1st	Manners	Ilkeston (Derbyshire).	Manners Colliery Co.	John William Argyle.	21	Onsetter	Whilst attempting to move the cage catches he lost his balance, and fell head first into the sump. Died same day.	–	–	1	–	–	1
44	Oct. 26 2.30 p.m.	8th	Nuneaton Clay Mine.	Nuneaton (Warwickshire).	Stanley Brothers	George Dawson	36	Clay miner	Fall of roof. Deceased was getting down clay, when a quantity of roof fell upon him.	–	1	–	–	–	1
45	Nov. 3 9.0 a.m.	2nd	Manners	Ilkeston (Derbyshire).	Manners Colliery Co.	William Critch	29	Holer	Fall of coal. The stallman eased some sprags near where deceased was working, and the coal fell over on to the deceased.	–	1	–	–	–	1
46	Nov. 6 9.0 a.m.	2nd	Wyken	Coventry (Warwickshire).	Wyken Colliery Co.	Thomas Marston	16	Doorkeeper	Deceased was assisting to lift a full tub on the rails. When this was done the tub moved forward, and crushed deceased's head between a door frame and the tub.	–	–	–	1	–	1
47	Nov. 6 1.30 p.m.	6th	Cadley Hill (Woodfield coal).	Burton-on-Trent (Derbyshire).	Hall and Boardman	John Smith	64	Stallman	Fall of coal. A shot had been fired in the coal, but did not bring it down. The sprags were re-set, and deceased was holing when the coal fell upon him.	–	1	–	–	–	1

List of Fatal Accidents—*continued.*

No. of Accidents.	Date and Hour of the Accident.	Hour of the Person's Shift, i.e., No. of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Firedamp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Aboveground.	Total.
48	1893. Nov. 6 3.0 p.m.	8th	Wollaton (Hard Coal).	Nottingham (Notts).	Wollaton Colliery Co.	Albert Edward Hale	18	Holer	Fall of coal. A shot had been fired within a short distance of where the deceased was holing. The shot and the easing of the sprags probably caused the coal to fall.	–	1	–	–	–	1
49	Nov. 20 12.40p.m.	6th	Watnall	Nottingham (Notts).	Barber, Walker, & Co.	John Thomas Fisher.	12	Assistant horse driver.	Fall of side whilst travelling along a roadway behind a train of full tubs.	–	1	–	–	–	1
50	Nov. 27 10.0 a.m.	3rd	New London (soft coal).	Kimberley (Notts).	Digby Colliery Co.	George Simpson	26	Loader	Fall of roof. Whilst looking for some rail nails in the roadway a piece of roof fell upon the deceased.	–	1	–	–	–	1
51	Nov. 28 10.50a.m.	5th	Hucknall (No. 2)	Nottingham (Notts).	Hucknall Colliery Co.	William Jones	25	Corporal	The deceased man injured himself whilst lifting a full tub on the roadway. He was using a belt and short chain, and appears to have injured his spine. He died on 11th December.	–	–	–	1	–	1
52	Nov. 30 6.50 p.m.	5th	Birley (East pit)	Sheffield (Derbyshire).	Sheffield Coal Co.	William Dent	36	Stallman	Fall of coal. Deceased had taken out a holing sprag and cut through the coal, and although	–	1	–	–	–	1

List of Fatal Accidents—*continued.*

No. of Accidents.	Date and Hour of the Accident.	Hour of the Person's Shift, i.e., No. of Hours he had been at work when the Accident happened to him	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Firedamp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Aboveground.	Total.
	1893.								they were drawn from the roof, he went under the coal. The deputy passed through the stall a short time previously, and called attention to the danger, but unfortunately did not remain and see it removed.						
53	Dec. 15 1.30 p.m	8th	Alvecote -	Tamworth (Warwickshire).	Tamworth Colliery Co.	Joseph Smith -	30	Collier -	Deceased was pulling down coal with a crowbar, when he slipped and fell down, and before he could recover himself the coal fell upon him.	–	1	–	–	–	1
54	Dec. 19 11.0 a.m.	4th	Watnall -	Nottingham (Notts).	Barber, Walker & Co.	Thomas Meakin -	34	Holer -	Whilst getting coal a piece of overhanging stone fell and fatally injured the man. The coal is holed on the top, and the stone was part o the holing, and should have been taken down instead of being left overhanging. He died on on the 22nd.	–	1	–	–	–	1
55	Dec. 20 10.53a.m.	4th	Netherseal -	Burton-on-Trent (Derbyshire).	Netherseal Colliery Co.	Job Hackwell -	21	Banksman -	Deceased was hit by the slipper of the cage. He appears to have thought that the tubs were not securely fixed on the cage, and was probably trying to fasten them, when the cage descended and caught him.	–	–	–	–	1	1

List of Fatal Accidents—*continued.*

No. of Accidents.	Date and Hour of the Accident.	Hour of the Person's Shift, *i.e.*, No. of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Firedamp.	Lives lost. Falls of Roof and Sides.	Lives lost. In Shafts.	Lives lost. Miscellaneous Underground.	Lives lost. Aboveground.	Lives lost. TOTAL.
56	1893 Dec. 29 9.0 a.m.	4th	Reservoir -	Moira (Leicestershire).	Moira Colliery Co. -	Robert Finch -	67	Deputy -	The deceased was an official of the mine, and was responsible for firing the shots. The mode of firing was by "germans," and the shot appears to have fired directly he lighted the end of the "german."	–	–	–	1	–	1
									Total - -	2	26	5	17	8	58
									Deaths in collieries - - - - -						58
									Number of separate accidents - - - - -						56

SUMMARY, 1893.

——	1892.	1893. Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	TOTAL.
Accidents - -	1	8	14	—	6	3	3	4	—	1	4	8	4	56
Deaths - -	1	8	15	—	6	3	4	4	—	1	4	8	4	58

APPENDIX III.

LIST of the FATAL ACCIDENTS, and DEATHS arising therefrom, of PERSONS EMPLOYED on PRIVATE BRANCH RAILWAYS and TRAMWAYS, and in WASHING and COKING COAL on Premises adjacent to or belonging to the MINES in the MIDLAND DISTRICT during the year 1893.

No. of Accidents.	Date and Hour of the Accident.	Hour of the Person's Shift, i.e., No. of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Branch Railways.	Coke Washing.	Coke Ovens.	Miscellaneous.	Total.
	1893. Feb. 11 9.0 a.m.	3rd	Moorgreen -	Eastwood (Notts)	Barber, Walker, & Co. -	William Richmond -	—	Farm labourer.	Was unloading manure in the Colliery Farm siding, when a passing train frightened the horse and dragged deceased under the moving trucks.	1	–	–	–	1
	May 6 10 a.m.	4th	Haunchwood -	Nuneaton (Warwickshire).	Sir A. Hickman -	William Bailey -	53	Labourer -	Was knocked down by some trucks which were being shunted into the colliery sidings.	1	–	–	–	1
	July 5 6.0 p.m.	11th	Warsop - -	Mansfield (Notts)	Staveley Coal and Iron Co.	Lavender Calow -	38	Engineman	Was unloading a sinking engine bed, and died from "syncope" following a shock caused by quickly jumping away from danger of being crushed by the engine falling from the truck.	1	–	–	–	1
	Sept. 29 4.0 p.m.	9th	South Leicestershire.	Coalville (Leicestershire).	South Leicestershire Colliery Co.	Thomas Weston -	16	Office boy -	He attempted to put a sprag between the wheels of a moving waggon loaded with bricks. The sprag flew out and threw deceased under the waggon. Deceased had been cautioned not to interfere with the waggon.	1	–	–	–	1
										4	–	–	–	4

APPENDIX IV.

The following DEATHS occurring in or about the MINES of the MIDLAND DISTRICT have been reported during the year 1893.

No. of Accidents.	Date of Death.	Name of the Mine or Colliery.	Where situate.	Name of Owner or Company.	Persons killed or injured.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.
	1893. Jan. 19	Speedwell, Pentrich	Ripley - -	W. C. Haslam - -	George Hunt -	68	Dataler -	Seized with a fit whilst in the pit preparing to commence work.
	Feb. 3	Teversal - -	Mansfield - -	Stanton Ironworks Co., Ltd.	Charles Longley -	58	Locomotive cleaner.	Died suddenly whilst at work in the locomotive shed. No accident or injury to the man.
	„ 19	Skegby - -	Mansfield - -	New Skegby Colliery Co. -	Matthew Green -	34	Banksman -	Committed suicide by jumping down the shaft. It is supposed that an illness caused his mind to be deranged.
	Mar. 2	Annesley - -	Nottingham - -	Annesley Colliery Co. -	Edward Rilley -	68	Banksman -	Died from pneumonia after undergoing an operation. He had received a slight accident on 2nd February, but this did not contribute to his death.
	„ 10	Woodside, Shipley -	Derby - -	E. M. Mundy - -	Arthur White -	15	Horse driver	Died from mortification, due to a strain to his bowels, but no evidence to show how it occurred.
	June 27	Lodge - -	Eastwood - -	William Hall - - -	George Widdowson -	63	Holer -	Died suddenly in the mine from natural causes. No accident or injury.
	July 17	Linby - -	Nottingham - -	Linby Colliery Co. -	Alfred Bettison -	18	—	Was going under some loaded railway waggons which were being moved, and was run over. He was not employed at the colliery, and the accident happened on the Great Northern branch line.

List of Fatal Accidents—*continued.*

No. of Accidents.	Date of Death.	Name of the Mine or Colliery.	Where situate.	Name of Owner or Company.	Person's Killed or Injured.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.
	1893. July 18	Donisthorpe	Ashby-de-la-Zouch	Checkland & Co.	John Evans	65	Stallman	Died from "syncope." The man received a slight injury to his leg on June 30th. The doctor stated that such injury had nothing to do with his death, but that death was due to sudden failure of the heart's action. No inquest was held.
	Aug. 15	Swannington	Ashby-de-la-Zouch	Cox and Turner	William Levett	16	—	Was not employed at the colliery. Whilst bathing in the colliery pond was drowned.
	Nov. 28	Clay Cross No. 3	Chesterfield	Clay Cross Colliery Co.	Thomas Wood	48	Stallman	Died suddenly in the mine whilst walking from his work to the pit bottom. Jury returned a verdict that he died of "heart disease."

REPORT on the working of the METALLIFEROUS MINES ACTS OF PARLIAMENT of 1872 and 1875, during the Year ending the 31st December 1893; by ARTHUR H. STOKES, Esq., F.G.S.

SIR, Green Hill, Derby, March 1894.

I HAVE the honour to forward you the following report upon the working of the Metalliferous Mines Acts, during the year 1893, in the district which includes the counties of Bedford, Berks, Buckingham, Cambridge, Derby, Hertford, Huntingdon, Leicester, Northampton, Nottingham, Oxford, Rutland, and Warwick.

There has not been a fatal accident in the metalliferous mines of this district during the year. A few non-fatal accidents have been reported, but none calling for special report.

Quantity of Mineral.

The total quantity of all sorts of mineral raised during the year was 90,648 tons, being a decrease of 6,048 tons as compared with the quantity raised during the preceding year.

Gypsum.

The quantity of gypsum raised from Mines was 52,766 tons, as compared with 60,839 tons in the previous year, a decrease of 8,073 tons. The same number of mines have been worked, there being none abandoned or newly opened during the year, and the falling off in quantity can only be accounted for by the requirements of trade.

There is a large quantity of Gypsum worked from open mines in the district, which will be found recorded in the Mineral Statistics for the year.

Lead.

The quantity of lead raised was 4,343 tons, or 533 tons in excess of the quantity raised in the previous year.

The lead trade still remains in a depressed state as regards price, and although there are many mines in Derbyshire which still remain in possession, and occasionally visited by the owners, yet a large number have not measured ore during the year, and what little work has been done, in many cases is simply for repairs and to retain possession under the peculiar mining laws of the district. Such mines are worked by the owners in their leisure time, and the ore kept in the mine until sufficient is obtained to call in the Barmaster to measure the same.

Other Minerals.

A quantity of Fuller's Earth is now being raised at Woburn in Bedfordshire, where shafts have been sunk and the minerals worked by mining in a regular and systematic manner.

The various descriptions of mineral mined in the district, and the quantity raised, will be seen from Table No. 10, page 45, and in cases where similar mineral is obtained by open work, the locality and quantities will be found in the Mineral Statistics for the year.

Inspection.

The closing of the coal mines of the district for some weeks in the autumn gave an opportunity for myself and assistants to devote the time thus set free to the work of inspecting the metalliferous mines under my charge.

The mines were not only inspected, but the miners' attention specially called to the various provisions of the Act relating to their safety, and copies of the Abstract of the Act were left with them for their future guidance.

Mineral Statistics.

The return of the quantities of mineral worked by openwork has been again collected and tabulated from returns given voluntarily by the owners and managers of mineral works.

I have again to thank all who have kindly favoured me with information relating to mineral wrought, and which enables me to prepare a correct and reliable statistical return of the total minerals of all classes wrought in the district.

I have, &c.,
ARTHUR H. STOKES,
H.M. Inspector of Mines.

The Right Hon. H. H. Asquith, M.P.,
Her Majesty's Principal Secretary of State,
Home Department, Whitehall, London.

TABLE No. 10.

SUMMARY of MINING PRODUCE in the MIDLAND DISTRICT in the year 1893.—
(MELALLIFEROUS MINES.)

Situation of Mines.	Kind of Mining Produce.	Tons.	Cwt.	Qrs.	Tons.	Cwt.	Qrs.
Bedfordshire	Fullers Earth	4,150	—	—			
					4,150	—	—
Buckinghamshire	Fireclay	200	—	—			
					200	—	—
Derbyshire	Gypsum	5,500	—	—			
	Lead	4,343	—	—			
	Chert	3,771	—	—			
	Calc-spar	3,451	—	—			
	Sand	910	—	—			
	Limestone	618	—	—			
	Barytes	459	—	—			
	Calamine, Zinc	356	—	—			
	Manganese	376	—	—			
	Ochre	307	—	—			
	Gannister	62	—	—			
	Fluor-spar	58	—	—			
					20,211	—	—
Leicestershire	Limestone	14,687	—	—			
					14,687	—	—
Nottinghamshire	Gypsum	47,266	—	—			
					47,266	—	—
Northamptonshire	Building stone	4,134	—	—			
					4,134	—	—
	Total Mineral				90,648	—	—

APPENDIX V.

FATAL ACCIDENTS, and LOSS of LIFE arising therefrom, in the METALLIFEROUS MINES in the MIDLAND DISTRICT during the Year ending 31st December 1893.

Date.	No. of Accidents.	Name of the Mine.	Where situate.	Owner's or Company's Name.	Persons killed.	Reputed Age.	Occupation.	Cause of Death, and Remarks.	No. of Lives lost.					
									Explosions of Firedamp.	Falls of Ground.	In Shafts.	Miscellaneous. Underground.	Aboveground.	Total.
No fatal accidents during the year 1893.														

APPENDIX VI.

No. 1.—SUMMARY of PERSONS EMPLOYED in and about the METALLIFEROUS MINES in the MIDLAND DISTRICT during the Year 1893.

Situation of Mines.	Underground.				Aboveground—Ages.							TOTAL underground and aboveground.
	Male Persons—Ages.				10 to 13.		13 to 18.		Above 18.		TOTAL.	
	12 to 13.	13 to 16.	Above 16.	TOTAL.	Males.	Females.	Males.	Females.	Females.	Males.		
Bedfordshire, Buckinghamshire, Derbyshire, Leicestershire, Nottinghamshire, and Northamptonshire	–	18	516	534	–	–	37	–	–	247	284	818

ARTHUR H. STOKES,
H.M. Inspector of Mines.

Reports of Assistant Inspectors.

15, Corporation Oaks, Nottingham,
31st January 1894.

Sir,

I have the honour to state that during the past year I have exercised the duties of Inspector of Mines in the Midland District; and, in pursuance of section 20 of the Metalliferous Mines Act, 1872, I beg to report that I have acted under the directions of Mr. Stokes, the Chief Inspector in charge of the district.

I have, &c.

(Signed) W. HUTTON HEPPLEWHITE.

The Right Hon. H. H. Asquith, Q.C., M.P.,
Her Majesty's Principal Secretary of State,
Home Department, Whitehall.

47, Hartington Street, Derby,
10th March 1894.

Sir,

I have the honour to report that during the year 1893 I have exercised the duties of an Inspector of Mines in the Midland District; and that in so doing I have acted under the direction of Mr. Stokes, the Chief Inspector in charge of the district.

I have, &c.

(Signed) H. RICHARDSON HEWITT.

The Right Hon. H. H. Asquith, Q.C., M.P.,
Her Majesty's Principal Secretary of State,
Home Department, Whitehall.

MINES.

REPORT

OF

C. LE NEVE FOSTER, Esq., H.M. INSPECTOR OF MINES

FOR THE

NORTH WALES, &c., AND ISLE OF MAN DISTRICT (No. 9),

TO

HER MAJESTY'S SECRETARY OF STATE,

UNDER THE

Metalliferous Mines Regulation Acts, 1872 and 1875, the Slate Mines (Gunpowder) Act, 1882, and the Metalliferous Mines (Isle of Man) Act, 1891.

For the Year 1893.

Presented to both Houses of Parliament by Command of Her Majesty.

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1894.

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Dr. C. Le Neve Foster's Report.

Report upon the Inspection of Mines classed under the Metalliferous Mines Regulation Acts, 1872 and 1875, in the Counties of Anglesey, Brecon, Cardigan, Carnarvon, Denbigh, Flint, Merioneth, Montgomery, Radnor, Kent, Middlesex, Surrey, and Sussex, and in the Isle of Man, for the Year 1893.—By C. Le Neve Foster, Esq., B.A., D.Sc., F.R.S., A.R.S.M.

Sir, Llandudno, 29th March 1894.

In compliance with section 20 of the Metalliferous Mines Regulation Act, I have the honour to present you my Annual Report for the year ended 31st December 1893.

I divide my Report into five chapters:—

Chapter I.—Number of persons employed at mines and certain openworks.

" II.—Quantity and value of minerals produced at mines and certain openworks.

" III.—List of fatal and non-fatal accidents at ore mines and certain other mines. List of fatal and non-fatal accidents at slate mines. Remarks about certain accidents. Summary. Comparison with the previous 18 years. Comparison between ore mines and slate mines as regards accidents. General results.

" IV.—Prosecutions in 1893: Holway United, Maen Offeren, Pentre Halkyn. Proceedings against workmen.

" V.—General remarks: Special rules. Ordinary exemptions. Exemptions under the Slate Mines (Gunpowder) Act. Abandoned mines. New mines. Unreported accidents. Summary of Work.

Chapter I.—Number of Persons employed at Mines and certain Openworks.

The following tables give summaries of the returns of persons employed in and about the mines and certain openworks in my district:—

Mines.

Persons employed in 1893 in and about Mines.

Situation of Mines.	Underground. Male Persons. Ages 12 to 13.	Underground. Male Persons. Ages 13 to 16.	Underground. Male Persons. Ages above 16.	Underground. Male Persons. Total.	Above Ground. Ages 10 to 13. Males.	Above Ground. Ages 10 to 13. Females.	Above Ground. Ages 13 to 18. Males.	Above Ground. Ages 13 to 18. Females.	Above Ground. Ages above 18. Females.	Above Ground. Ages above 18. Males.	Above Ground. Total.	Total underground and above ground.
Copper, Lead, Zinc, and other Mines, exclusive of Slate Mines.												
Anglesey	—	—	26	26	—	—	6	—	—	120	126	152
Breconshire	—	—	22	22	—	—	3	—	—	8	11	33
Cardiganshire	—	—	173	173	1	—	68	5	27	98	199	372
Carnarvonshire	—	4	78	82	—	—	21	—	—	71	92	174
Denbighshire	—	2	318	320	—	—	55	—	—	268	323	643
Flintshire	—	—	489	489	1	—	61	—	—	220	282	771
Merionethshire	—	—	71	71	—	—	11	—	—	48	59	130
Montgomeryshire	—	—	55	55	—	—	2	—	—	20	22	77
Radnorshire	—	—	2	2	—	—	—	—	—	—	—	2
Surrey	—	—	28	28	—	—	—	—	—	4	4	32
Sussex	—	—	15	15	—	—	1	—	—	21	22	37
Isle of Man	—	2	560	562	2	—	113	—	3	250	368	930
Totals, exclusive of the Slate mines	—	8	1,837	1,845	4	—	341	5	30	1,128	1,508	3,353
Slate Mines.												
Carnarvonshire	—	—	—	—	—	—	—	—	—	1	1	1
Denbighshire	—	—	38	38	—	—	4	—	—	32	36	74
Merionethshire	—	1	2,104	2,105	—	—	258	—	—	1,958	2,216	4,321
Montgomeryshire	—	—	3	3	—	—	2	—	—	4	6	9
Totals for the Slate mines	—	1	2,145	2,146	—	—	264	—	—	1,995	2,259	4,405
Totals for all the mines	—	9	3,982	3,991	4	—	605	5	30	3,123	3,767	7,758

Openworks.

Persons employed in 1893 at the Open Slate Quarries, Fuller's Earth, Ochre and Umber Pits, and Works treating Mine Refuse.

County.	Total Number of Persons.
Anglesey	31
Cardiganshire	9
Carnarvonshire	8,436
Denbighshire	31
Flintshire	33
Merionethshire	360
Montgomeryshire	99
Surrey	81
Isle of Man	3
Total	9,083

CHAPTER II.—QUANTITY AND VALUE OF MINERALS PRODUCED AT MINES AND CERTAIN OPENWORKS.

The Parliamentary Blue Book entitled "The Mineral Statistics of the United Kingdom" shows the produce of each mine in my district, and in this chapter I merely give a general summary for 1893.

MINES.

County.	Quantity.	Value at the Mines.
BARYTES.		
Montgomeryshire - - - -	Statute Tons. 697	£ 348
CLAY (FULLER'S EARTH).		
Surrey - - - - -	250	£ 560
COPPER ORE.		
Cardiganshire - - - -	5	£ 34
Merionethshire - - - -	30	57
	35	91
COPPER PRECIPITATE.		
Anglesey - - - - -	230	£ 2,210
GOLD ORE.		
Merionethshire - - - -	4,489	£ 7,657
GYPSUM.		
Sussex - - - - -	6,162	£ 3,083
IRON PYRITES.		
Carnarvonshire - - - -	5,220	£ 2,610

County.	Quantity.	Value at the Mines.
Lead Ore.		
	Statute Tons.	£
Breconshire - - - -	285	1,871
Cardiganshire - - - -	843	5,434
Carnarvonshire - - - -	32	102
Denbighshire - - - -	1,286	8,597
Flintshire - - - - -	4,891	31,965
Montgomeryshire - - - -	8	47
Isle of Man - - - -	6,427	53,503
	13,772	101,519
Manganese Ore.		
Merionethshire - - -	635	£ 354
Ochre and Umber.		
		£
Anglesey - - - - -	1,250	2,820
Isle of Man - - - -	200	400
	1,450	3,220
Slate and Slabs (dressed).		
		£
Denbighshire - - - -	2,167	5,152
Merionethshire - - - -	137,535	452,381
Montgomeryshire - - - -	410	820
	140,112	458,353
Stone, &c.		
		£
Denbighshire - - - -	16	1
Flintshire - - - -	200	30
Merionethshire - - - -	1,895	188
Montgomeryshire - - -	20	20
Surrey - - - - -	11,229	3,693
	13,360	3,932
Zinc Ore.		
		£
Anglesey - - - - -	740	1,480
Cardiganshire - - - -	2,688	8,534
Carnarvonshire - - - -	60	120
Denbighshire - - - -	5,993	30,734
Flintshire - - - - -	2,483	9,544
Montgomeryshire - - -	12	40
Isle of Man - - - -	3,628	11,697
	15,604	62,149

Total value - - - - 646,086*l.*

Compared with the previous year, there is a diminution in the quantities of barytes, clay, copper ore, gold ore, lead ore, manganese ore, ochre and zinc ore, and an increase in the quantities of gypsum, iron pyrites and slate.

OPENWORKS.

The output of certain openworks in 1893 was,—

County.	Quantity.	Value at the Openworks.
CLAY (FULLER'S EARTH).		
	Statute Tons.	£
Surrey - - - - -	7,494	12,197
LEAD ORE.		
		£
Flintshire - - - - -	36	181
OCHRE, ROTTENSTONE, AND UMBER.		
		£
Anglesey and Isle of Man - - -	682	1,450
SLATE AND SLABS (DRESSED).		
		£
Cardiganshire - - - -	220	412
Carnarvonshire and Denbighshire -	261,157	560,701
Merionethshire - - - -	10,153	25,683
Montgomeryshire - - -	2,284	6,178
	273,814	592,974
ZINC ORE.		
		£
Flintshire - - - - -	201	660

Total value - - - 607,462*l.*

As in the case of the underground workings, the open quarries produced rather more slate last year than they did in 1892.

CHAPTER III.—ACCIDENTS: LIST OF FATAL AND NON-FATAL ACCIDENTS AT ORE MINES AND CERTAIN OTHER MINES. LIST OF FATAL AND NON-FATAL ACCIDENTS AT SLATE MINES. REMARKS ABOUT CERTAIN ACCIDENTS. SUMMARY. COMPARISON WITH THE PREVIOUS 18 YEARS. COMPARISON BETWEEN ORE AND SLATE MINES AS REGARDS ACCIDENTS. GENERAL RESULTS OF THE YEAR.

The following tables contain an account of every accident reported to me during the year:—

LIST of the FATAL ACCIDENTS, and LOSS of LIFE arising therefrom, and of the NON-FATAL ACCIDENTS causing SERIOUS PERSONAL INJURY, or arising from EXPLOSIONS of GAS, POWDER, &c., or of any STEAM BOILER in the COPPER, LEAD, ZINC, and other MINES, exclusive of the SLATE MINES, in DR. C. LE NEVE FOSTER'S District during the Year 1893.

Date and Hour.	Hour of the Person's Shift.	No. of the Accident.	Name of the Mine.	Persons killed or injured. Names of Killed in thick type.	Occupation.	Reputed Age.	Length of Time the Person was prevented by the Effects of the Accident from resuming Work.	Cause of Accident, and Remarks.	No. of Persons killed.	No. of Persons injured.
				EXPLOSIONS OF FIREDAMP—None.						
				FALLS OF GROUND.						
1893. Apr. 28 11 a.m.	5th	21	Minera - -	**Elias Jones**	Miner - -	49	—	Fall of a stage or "bunning," from the unexpected giving way of the rock under the head of one of the pieces of timber which supported it. Jones was the "taker" of the bargain, and had himself put in the "bunning" a week before the accident.	1	-
June 19 9 a.m.	3rd	33	Frongoch -	William Mason	" - -	49	4 weeks -	A stone fell unexpectedly from the side of the stope, and broke two of his ribs.	-	1
Sept. 29 10.30 a.m.	3rd	55	Snaefell - -	William Tate -	" - -	39	3½ months -	Unexpected fall of ground in a stope. Tate is said to have tried the ground shortly before it fell and pronounced it safe.	-	1
								Total falls of ground -	1	2
				IN SHAFTS.						
				Overwinding.—None.						
				Ropes and Chains breaking.—None.						
				Whilst ascending or descending by Machinery.—None.						
				Falling into shaft from Surface.—None.						
				Things falling from Surface.						
Jan. 16 9.30 a.m.	3rd	4	South Halkyn and Rhydymwyn.	Edward Jones -	Miner - -	53	1 week - -	Struck by a small stone which fell down the shaft; possibly it came from a full waggon which had just reached the top.	-	1
				Falling from part way down.						
Jan. 17 11.45 a.m.	5th	5	Minera - -	**David Hughes.**	Foreman Timberman.	55	—	Although Hughes was one of the most experienced men in the mine, he fell into the shaft from the "lodge" or "plat" where he was standing. He had removed the fence in order to unload some timber, which he was expecting immediately.	1	-
May 13 10 a.m.	1st	25	Foxdale - -	**Walter Davies.**	Miner - -	30	—	He was standing on a platform in the shaft, and was endeavouring to unscrew a nut with a spanner. The spanner appears to have slipped, and the man fell with it down the part of the shaft used for the capstan rope; the pitman in charge admitted that it was through his neglect that the shaft was not covered over in a manner to prevent such an accident.	1	-
								Total in shafts - -	2	1

List of Accidents—*continued.*

Date and Hour.	Hour of the Person's Shift.	No. of the Accident.	Name of the Mine.	Persons killed or injured. Names of Killed in thick type.	Occupation.	Reputed Age.	Length of Time the Person was prevented by the Effects of the Accident from resuming Work.	Cause of Accident, and Remarks.	No. of Persons killed.	No. of Persons injured.
Things falling from part way down.—None. *Miscellaneous in Shafts*—None.										
MISCELLANEOUS UNDERGROUND. *Explosions of Gunpowder.*										
1893. Jan. 10 12.15 p.m.	7th	6	Halkyn	**Henry Jones** Gower Jones.	Miner "	50 44	— 13 weeks	They set fire to the fuses of two holes charged with gelatine dynamite, and retired to a safe place. After waiting a short time, they went back to their working place, under the impression that both shots had gone off. One hole, however, had hung fire, and exploded almost immediately after their return.	1	1
Mar. 1 11.45 a.m.	6th	10	Minera	Robert Lloyd	"	30	4 days	A detonator exploded while he was engaged fastening it to the end of the fuse, and cut him in the forehead.	–	1
Apr. 14 9 a.m.	3rd	13	Llanfairtalhaiarn near Abergele.	**Robert Lloyd**	"	33	—	Lloyd and his partner had bored and charged two holes in an "end." No. 1 was arranged to go off before No. 2. After Lloyd had lighted both candle ends or "snuffs," he saw No. 1 fuse "spit," and the "snuff" of No. 2 fall down. He retired to a safe place, heard No. 1 go off, and returned in order to relight No. 2; just as he got to the "end," No. 2 exploded, inflicting terrible injuries on his head and body. He had concluded that the "snuff" had fallen off before it had ignited the fuse, but he was mistaken.	1	–
Apr. 18 12.10 p.m.	7th	19	Halkyn	John Edwards	"	30	8 weeks	Explosion of a detonator while inserting the fuse; eyes injured severely.	–	1
Nov. 29 1 p.m.	7th	67	Bwlchglas	**William Edward.** Edward Jenkins. John Jones	" " "	40 27 26	— 6½ weeks 19 days	William Edward was pushing a cartridge of gelatine dynamite into a hole with a wooden rod, when it exploded. The hole was from 2 inches wide at the top to 1½ inch wide at the bottom, and the cartridges were ⅞ inch in diameter. There had been hard frosty weather about a week before the accident. Possibly he was using a somewhat hard cartridge.	1	2
Suffocation by Gases—None. *Irruptions of Water*—None. *Falling into Water*—None. *On Inclined Planes*—None. *By Trams and Tubs.*—None. *By Machinery Underground*—None.										
June 6 3 p.m.	1st	28	Halkyn	Benjamin Jones	Miner	49	2 weeks	After raising a piece of timber with the windlass, he let the chain run down without any load, and he was struck by the handle. Face bruised; tooth knocked out.	–	1
Sundries Underground.										
Mar. 1 10 a.m.	4th	9	Minera	John Ellis	Miner	57	51 weeks	He was stepping from one large stone to another and caught his leg between them; this caused him to fall and fracture one of the bones of the left leg.	–	1
April 6 9 a.m.	3rd	16	Frongoch	Thomas Davies	Pitman	35	2 weeks	Chain broke as he was climbing into an old "pitch." Ancle sprained.	–	1
								Total miscellaneous underground.	3	8
ON SURFACE. *Machinery on Surface.*										
Jan. 3 1.30 p.m.	7th	2	Foxdale	William Clarke	Pupil teacher	17	4 months	He was assisting to turn the flywheel of an engine and slipped into the crank pit; leg fractured below the knee. He was temporarily at work on the dressing floors during Christmas holidays.	–	1
Mar. 24 11 a.m.	4th	13	Bryn-y-afr.	John Jones	Lander	40	16 days	He was engaged with three others in sending a piece of larch 9 feet long down the shaft with a winch. Somehow he let go, and the handle struck him on the side.	–	1
Mar. 29 1.30 p.m.	7th	14	Foxdale	Robert Corkill	Engineman	54	4 months	While making some trials with a newly-erected condenser he inadvertently placed himself so that he was struck by a moving guide-rod. Leg broken below the knee.	–	1

List of Accidents—*continued.*

Date and Hour.	Hour of the Person's Shift.	No. of the Accident.	Name of the Mine.	Persons killed or injured. Names of Killed in thick type.	Occupation.	Reputed Age.	Length of Time the Person was prevented by the Effects of the Accident from resuming Work.	Cause of Accident, and Remarks.	No. of Persons killed.	No. of Persons injured.
				Boilers bursting—None.						
				Miscellaneous on Surface.						
1893. Oct. 13. 1.30 p.m.	7th	58	Halkyn - -	John Pugh -	Labourer -	72	Has not yet resumed work March 1894.	Fell from a cart while loading hay; broke small bone of his arm.	–	1
								Total on surface - - -	–	4
								Gross total for the copper, lead, zinc, and other mines, exclusive of the slate mines.	6	15

List of the Fatal Accidents, and Loss of Life arising therefrom, and of the Non-fatal Accidents causing Serious Personal Injury, or arising from Explosions of Gas, Powder, &c., or of any Steam Boiler, in the Slate Mines in Dr. C. Le Neve Foster's District during the Year 1893.

Date and Hour.	Hour of the Person's Shift.	No. of the Accident.	Name of the Slate Mine.	Persons killed or injured. Names of Killed in thick type.	Occupation.	Reputed Age.	Length of Time the Person was prevented by the Effects of the Accident from resuming Work.	Cause of Accident, and Remarks.	No. of Persons killed.	No. of Persons injured.
				Explosions of Fire-damp—None.						
				Falls of Ground.						
1893. Jan. 6 4.30 p.m.	9th	3	Braichgoch -	**David Edwards.**	Rockman -	53	—	A block of slate slid down unexpectedly from the working face, and the man hearing the noise ran away; unfortunately he happened to go just where it was coming down, and he was struck by it and killed.	1	–
April 19 11 a.m.	4th	20	Llechwedd -	William Owen -	" -	62	Has not yet resumed work, March 1894.	While he was erecting a small stage on the working face of his "bargain" a small piece of slate came away unexpectedly, slid down and struck him. Leg broken above ankle.	–	1
May 3 11 a.m.	4th	22	Oakeley - -	Robert Roberts	" -	35	"	A stone weighing about a ton, which had just been blasted, slipped unexpectedly down the forebrest of the chamber and cut his ankle severely as it passed him.	–	1
July 27 8 p.m.	2nd	39	New Welsh Slate	William Roberts	Miner - -	44	"	He was making the side of a chamber secure, when a piece of slate fell from the roof and struck him. Right thigh fractured and left hip joint dislocated.	–	1
Sept. 6 2 p.m.	7th	49	New Welsh Slate	John Jones -	Rockman -	36	"	He was on the working face prizing down a piece of rock; in its fall it struck the tail end of his supporting chain and caused it to squeeze his thigh. Severe contusion of thigh.	–	1
Sept. 8 4 p.m.	9th	50	Oakeley - -	**John Jones**	" -	45	—	Fall of a big block of slate from the working face. He had fired a hole in order to bring down the block, but as it did not come away at once, he climbed up and he said he would re-charge the hole. At this moment the block fell and struck him. His partner had begged him to wait a bit, as is usual, before going up the face.	1	–
Oct. 19 11 a.m.	4th	59	Llechwedd - -	Richard Edwards.	" -	36	15 weeks -	A small piece of slate slipped from the face of the bargain, and fell upon his thumb. Compound fracture.	–	1
Nov. 7 3.30 p.m.	8th	62	Oakeley - -	**Owen Williams.** John Williams -	" - " -	42 37	— 12 weeks -	Unexpected fall of a block of slate weighing about 2¾ tons from the side of the chamber in which they were working. The piece fell from a height of 53 feet from a place far beyond the men's reach, which could not be minutely examined without rigging up ladders specially. The chamber had been inspected by the men and agents with the aid of the Wells light about two months before the accident, and pronounced safe. John Williams received injuries to the head and one leg.	1	1

List of Accidents—*continued.*

Date and Hour.	Hour of the Person's Shift.	No. of the Accident.	Name of the Slate Mine.	Persons killed or injured. Names of Killed in thick type.	Occupation.	Reputed Age.	Length of Time the Person was prevented by the Effects of the Accident from resuming Work.	Cause of Accident, and Remarks.	No. of Persons killed.	No. of Persons injured.
1893. Nov. 14 9 a.m.	2nd	64	Votty and Bowydd.	**Evan W. Roberts**	Rockman	[illegible]2	—	Fall of a piece of slate, weighing about 4 cwt., which he was in the act of getting down. It caught his leg against a sharp stone, which severed the main artery in the calf. Though his comrades succeeded in stopping the bleeding within eight minutes after the accident, he died from the loss of blood and the shock in less than two hours.	1	-
Dec. 11 2.30 p.m.	7th	71	Rhosydd	John R. Griffith	„	24	Unfit for work underground.	He was engaged in cutting "free side" on one side of a chamber, when a thick slice of the upper part of the working face came away unexpectedly from a joint and struck him in its fall. The piece which fell was estimated to weigh 80 tons. Thigh and leg fractured. Leg amputated above the knee.	-	1
								Total falls of ground	4	7

IN SHAFTS—None.

MISCELLANEOUS UNDERGROUND.

Explosions of Gunpowder.

Date and Hour.	Hour of the Person's Shift.	No. of the Accident.	Name of the Slate Mine.	Persons killed or injured.	Occupation.	Reputed Age.	Length of Time	Cause of Accident, and Remarks.	No. of Persons killed.	No. of Persons injured.
Mar. 22 9.30 a.m.	3rd	12	Oakeley	John Jones	Rockman	40	24½ weeks	A hole charged with gunpowder exploded prematurely while he was in the act of tamping it with a bar tipped with bronze; he lost the sight of one eye.	-	1
April 6 9.30 a.m.	3rd	17	Oakeley	Robert Evans	„	28	8½ weeks	Premature explosion of a charge of gunpowder in a hole about 8 or 10 inches deep, while he was in the act of ramming in tamping with a bar tipped with bronze. Eye injured.	-	1
May 5 11 a.m.	4th	24	Aberllefenny	Richard Davies	Miner	7	5½ weeks	He did not retire to a safe place while firing a shot in a level, and was struck by a stone which rebounded.	-	1
June 12 11 a.m.	5th	32	Oakeley	Thomas Jones	Rockman	45	1½ weeks	He was preparing to re-fire a hole which had been blasted once and had produced a crack; accidentally he let the lighted candle-end ("snuff") fall into the charge of gunpowder, which exploded. By good fortune he was only slightly injured.	-	1
July 7 5.20 p.m.	10th	37	Oakeley	Humphrey Jones Owen Williams	„ „	23 21	4 days 2½ weeks	Explosion of a charge of guncotton and gunpowder, while they were unramming the hole, which had missed fire. They were prosecuted.	-	2
Aug. 3 11 a.m.	4th	40	Oakeley	Jeremiah Williams.	Rockman	55	4½ weeks	He was boring in a socket left by a hole which had been fired a month before, when an explosion occurred. It was probably due to remnants of guncotton which did not go off the first time. Slight injuries to the eyes.	-	1
Aug. 10 2 a.m.	8th	42	„	Thomas Rees	Miner	28	3½ weeks	He was ramming a wad upon a charge of gelignite with a brass-tipped tamping bar when it exploded. Injuries slight.	-	1
Aug. 17	8th	46	„	John Jones	Rockman	26	2 weeks	He was pouring a few ounces of gunpowder into a crack formed by firing some gelignite, when it exploded. It is supposed that there were a few grains of loose powder about the top of the crack, and that a spark from his candle set fire to them and so ignited the whole charge.	-	1

Suffocation by Gases—None.

Irruptions of Water—None.

Falling into Water—None.

On Inclined Places—None.

Date and Hour.	Hour of the Person's Shift.	No. of the Accident.	Name of the Slate Mine.	Persons killed or injured.	Occupation.	Reputed Age.	Length of Time	Cause of Accident, and Remarks.	No. of Persons killed.	No. of Persons injured.
Mar. 11 10.45 a.m.	3rd	11	Maen Offeren	**John Evans**	Miner	—	—	While the deceased was engaged in blasting away the floor of an incline at the side of the line of rails, a truck became loose from a chain breaking and ran down violently. The deceased was struck by the truck or the load as it passed him. See Chap. III., Prosecutions.	1	-

List of Accidents—*continued.*

Date and Hour.	Hour of the Person's Shift.	No. of the Accident.	Name of the Slate Mine.	Persons killed or injured. Names of Killed in thick type.	Occupation.	Reputed Age.	Length of Time the Person was prevented by the Effects of the Accident from resuming Work.	Cause of Accident, and Remarks.	No. of Persons killed.	No. of Persons injured.
				By Trams and Tubs.						
1893. Sept. 1 9 a.m.	2nd	48	Rhosydd	Hugh Evans	Labourer	39	19 weeks	His foot slipped while he was pushing a loaded waggon along a level, and he fell between the waggon and the side. He was severely squeezed on the back.	–	1
Oct. 27 9 a.m.	2nd	61	Wrysgan	John Griffith	"	50	13 weeks	He was tramming in a level, and he pushed his empty truck against a full one coming in the opposite direction; he had his nose badly cut by the projecting load of slate Deafness prevented his hearing the approach of the truck.	–	1
				By Machinery Underground.						
Aug. 9 11.30 a.m.	5th	41	Oakeley	John Jones	Clearer	27	2¾ weeks	Hit by the handle of the crane he was working with at the time. He was raising a small block of slate with a crane, and let go the handle, which turned round and struck him on the side of the head.	–	1
Dec. 7. 3 p.m	7th	70	Llechwedd	William Jones	Rockman	38	3 weeks	He turned the spur-wheel of the crane winch with his hand, and had his little finger caught between the cogs and severely fractured.	–	1
				Sundries Underground.						
Jan. 23 10.30 a.m.	3rd	7	Oakeley	Robert Owen	Rockman	31	25 weeks	A large block of slate which was suspended by a crane swung a little, and striking his hand, injured it severely.	–	1
Apr. 1 10 a.m.	3rd	15	"	John Williams	"	58	7½ weeks	Hand caught while putting a roller under a large stone; thumb cut off.	–	1
May 31 3 p.m.	8th	26	Braichgoch	**Owen Jones**	"	56	—	He was startled by a falling chain, and, while walking backwards rapidly along the floor of the chamber, stumbled and fell against a waggon loaded with slate rubbish which was standing in the tram road. The blow caused a bad scalp wound and concussion of the brain, and he died from these injuries nine days afterwards.	1	–
May 18 10 a.m.	3rd	30	New Welsh Slate	Griffith Griffiths	"	59	3 weeks	A small piece of slate which he was lifting fell on to his big toe.	–	1
June 23 3 p.m.	8th	34	Oakeley	Owen Jones	"	50	14½ weeks	A 2-ton stone lurched while he was splitting it and squeezed his right foot, fracturing one of the toes.	–	1
June 30 7.30 a.m.	1st	35	"	William Carefoot	Labourer	45	9½ weeks	A small stone rolled down the "fall" in an underground chamber, and struck him on the head.	–	1
Aug. 11 1.30 p.m.	7th	44	New Welsh Slate	Isaac Benjamin	Repairer	40	4 weeks	Isaac Benjamin and his partner were repairing the top of the chamber. Benjamin was climbing up the face of the rock by a chain, but when he had got up only two or three yards from the floor, the chain broke, and he fell against a crane. Back severely contused.	–	1
Aug. 14 5 p.m.	10th	45	Votty and Bowydd.	Henry Williams	Rockman	43	Has not yet resumed work, March 1894.	He was raising a block of slate with a crane, and startled by a noise, he turned round suddenly to move away; in so doing, he fell and broke his leg just above the ankle.	–	1
Aug. 31 7.30 a.m.	1st	47	New Welsh Slate	William R. Williams.	"	28	4½ weeks	When running to escape from a stone rolling down the working face, he caught his hand in a waggon and broke one of the bones.	–	1
Sept. 11 2.30 p.m.	7th	51	Oakeley	John Jones	"	28	10½ weeks	Fell down the working face from his rope breaking. Apparently the rope had been partly severed by a fall of rock, and the injury had escaped his notice.	–	1
Sept. 15 11.40 a.m.	4th	52	Maen Offeren	John Jones	"	46	28 week	While John Jones was loading two blocks of slate with a crane on to a truck, one slipped out of the chain in which they were slung and struck him, breaking his leg in two places.	–	1

List of Accidents—*continued.*

Date and Hour.	Hour of the Person's Shift.	No. of the Accident.	Name of the Slate Mine.	Persons killed or injured. Names of Killed in thick type.	Occupation.	Reputed Age.	Length of Time the Person was prevented by the Effects of the Accident from resuming Work.	Cause of Accident, and Remarks.	No. of Persons killed.	No. of Persons injured.
1893. Sept. 25 3.0 p.m.	8th	53	New Welsh Slate	John Owen -	Rockman -	48	4 weeks - -	His foot slipped just as he started to climb up the working face with a chain, and he fell against a rock. Ribs fractured.	-	1
Nov. 30 9.0 a.m.	2nd	68	Llechwedd -	William Jones -	" -	57	4½ weeks -	While standing on the working face, slipped from his chain and fell 9 feet on to some stones lying on the floor of the chamber. Some of his ribs broken.	-	1
Dec. 6 8.30 a.m.	1st	69	Aberllefenny -	John G. Lewis -	Labourer -	23	Has not yet resumed work, March 1894.	A piece of rock had been lowered by a crane in a chamber above until one end rested on a truck in a level. Lewis was pushing the block into position, when it slipped out of the chain by which it was suspended, fell over the side of the truck, and struck him on the leg. Compound fracture of leg.	-	1
								Total miscellaneous underground	2	26

On Surface.

By Machinery on Surface.

May 3 5 p.m.	9th	23	Llechwedd -	William Lloyd -	Quarryman -	21	10 weeks -	Placed his left hand under the knife of a dressing machine; middle finger cut off.	-	1
June 1 10 a.m.	3rd	27	Oakeley - -	John Thomas -	Labourer -	45	4½ weeks - -	A big stone which was being dragged with a crane lurched, and caused the handle to strike his arm and break it.	-	1
Feb. 23 3 p.m.	7th	29	New Welsh Slate	Simeon Jones -	Slate maker -	19	6 weeks - -	He was sitting inside a sawing table and was filing a saw. He foolishly had not stopped the table, and his leg was caught by a projecting set-screw and squeezed.	-	1
Sept. 29 3 p.m.	8th	54	Ditto - -	Hugh Thomas -	" -	15	Has not yet resumed work, March 1894.	He inadvertently put his hand too far, while dressing slates with a machine, and had the flesh torn off some of his fingers.	-	1
Oct. 13 11.30 a.m.	8th	57	Oakeley - -	Rt. John Williams	Slate splitter and dresser.	42	15 weeks - -	Thumb cut off while he was using the circular saw of an ordinary slate-sawing table to cut up some faggots for firewood.	-	1

Boilers bursting—None.

Miscellaneous on Surface.

Jan. 4 10.15 a.m.	3rd	1	Oakeley - -	John Lloyd Jones	Quarryman	29	Permanently disabled from following his occupation.	Some large stones slipped down while he was excavating rock and rubbish of the "fall," and one caught his leg, inflicting injuries which necessitated amputation above the knee.	-	1
Feb. 7 1.30 p.m.	6th	8	Ditto - -	Isaac Roberts -	Clearer - -	24	11 weeks - -	Squeezed between two trucks whilst in the act of unhooking them; collar-bone fractured.	-	1
May 19 9 a.m.	2nd	31	New Welsh Slate	Lewis Roberts -	Slate maker -	58	About 4 weeks -	While he was unloading a sled, had his hand caught by a block of slate; the skin and flesh were torn from his finger. He recovered from this injury, but was taken ill with cancer, and died of this complaint.	-	1
July 5 2 p.m.	7th	36	Oakeley - -	Morris Jones -	Miner - -	45	10½ weeks - -	A stone about 10 lbs. in weight rolled some three or four yards down the "fall," and hit Jones on the shoulder, fracturing a bone.	-	1
July 21 1.30 p.m.	7th	38	Ditto - -	Robert Isaac Jones	Hooker-on -	19	6½ weeks - -	Two waggons were being drawn up an incline, and, when about 20 yards from the top, a link of the chain at the end of the wire-rope broke; the waggons ran down and collided with two empty waggons at bottom. The slate in the runaways was thrown out, and a large piece struck Jones.	-	1
Aug. 11 8 a.m.	1st	43	Ditto - -	Evan Roberts -	Carter - -	20	11 weeks - -	Roberts was standing carelessly on a low trolley drawn by a horse; his foot slipped on to the rail, and the trolley passed over his leg, breaking it just above the ankle.	-	1
Oct. 12 4.30 a.m.	9th	56	New Welsh Slate	Daniel Jones	Carter - -	18	7½ weeks - -	Had his forefinger caught while unhooking a horse from a train of waggons. Piece of finger cut off.	-	1

Date and Hour.	Hour of the Person's Shift.	No. of the Accident.	Name of the Slate Mine.	Persons killed or injured. Names of Killed in thick type.	Occupation.	Reputed Age.	Length of Time the Person was prevented by the Effects of the Accident from resuming Work.	Cause of Accident, and Remarks.	No. of Persons killed.	No. of Persons injured.
Oct. 19 4 p.m.	9th	60	Llechwedd -	William Parry -	Slate loader -	46	Has not yet resumed work, March 1894.	Slipped against one of the rails while unhooking an empty waggon at the top of an incline; fell and broke the small bone (fibula) of his left leg.	–	1
Nov. 8 5 p.m.	After working hours	63	Wrysgan - -	Charles Lloyd -	Rockman -	24	6 weeks - -	In order to reach home more quickly on leaving the mine, he slid down a steep incline, seated on a stone, though forbidden to do so. He overbalanced himself during the rapid descent, and fell over the side to a depth of more than 20 feet, breaking an ankle and hurting his ribs.	–	1
Nov. 18 11.30 a.m.	5th	65	Ditto - -	Thomas Roberts	Weighman -	40	3 weeks - -	He was starting from the mine to go home, and was blown over the rubbish tip. Forehead badly cut. The weather was exceptionally stormy.	–	1
Nov. 22 8 a.m.	1st	66	Oakeley - -	JohnOwenJones	Rockman -	32	3½ weeks - -	He was working on the "fall," and had put a second charge of powder into a crack formed by a first blast. While waiting for the general signal for firing, some ashes of his burning touch paper were blown away and ignited the powder. Face burnt.	–	1
Dec. 13 3 p.m.	7th	72	New Welsh Slate	Thomas Morgan	Tipman - -	53	1 month - -	While carrying a block of slate he tripped and fell; hand severely cut by the sharp edge of the slate.	–	1
								Total on surface - - -	–	17
								Gross total for the slate mines -	6	50

My list of accidents may be summed up as follows :—

Cause of Accident.	Copper, Lead, Zinc, and other Mines, exclusive of the Slate Mines.			Slate Mines.			Totals for all the Mines.		
	Number of separate accidents.	Number of persons killed.	Number of persons injured.	Number of separate accidents.	Number of persons killed.	Number of persons injured.	Number of separate accidents.	Number of persons killed.	Number of persons injured.
Explosions of firedamp - -	—	—	—	—	—	—	—	—	—
Falls of ground - - - - -	3	1	2	10	4	7	13	5	9
IN SHAFTS.									
Overwinding - - - - - -	—	—	—	—	—	—	—	—	—
Ropes or chains breaking - -	—	—	—	—	—	—	—	—	—
Whilst ascending or descending by machinery.	—	—	—	—	—	—	—	—	—
Falling into shaft from surface - -	—	—	—	—	—	—	—	—	—
Things falling from surface - - -	1	—	1	—	—	—	1	—	1
Falling from part way down - -	2	2	—	—	—	—	2	2	—
Things falling from part way down -	—	—	—	—	—	—	—	—	—
Miscellaneous in shafts - - -	—	—	—	—	—	—	—	—	—
Total in shafts - - - -	3	2	1	—	—	—	3	2	1
MISCELLANEOUS UNDERGROUND.									
Explosions of gunpowder, &c. - -	5	3	5	8	—	9	13	3	14
Suffocation by gases - - - -	—	—	—	—	—	—	—	—	—
Irruptions of water - - -	—	—	—	—	—	—	—	—	—
Falling into water - - - -	—	—	—	—	—	—	—	—	—
On inclined planes - - - -	—	—	—	1	1	—	1	1	—
By trams and tubs - - -	—	—	—	2	—	2	2	—	2
By machinery underground - -	1	—	1	2	—	2	3	—	3
Sundries underground - - -	2	—	2	14	1	13	16	1	15
Total miscellaneous underground -	8	3	8	27	2	26	35	5	34
ON SURFACE.									
By machinery on surface - - -	3	—	3	5	—	5	8	—	8
Boilers bursting - - - -	—	—	—	—	—	—	—	—	—
Miscellaneous on surface - -	1	—	1	12	—	12	13	—	13
Total on surface - - - -	4	—	4	17	—	17	21	—	21
Gross total - - -	18	6	15	54	6	50	72	12	65

The total number of accidents reported is 16 more than in 1892; there is a decrease of 2 in the number of persons killed, and an increase of 18 in the number of persons injured.

The causes of the fatal accidents in 1893 may be compared with those of the 18 previous years by the following table :—

General Table of Fatal Accidents and Deaths at the Mines in Dr. C. Le Neve Foster's District from 1875* to 1893.

—	Number of Fatal Accidents.										Number of Deaths resulting therefrom.									
	Totals for the 10 years 1875 to 1884.	1885.	1886.	1887.	1888	1889.	1890.	1891.	1892.	1893.	Totals for the 10 years 1875 to 1884.	1885.	1886.	1887.	1888.	1889.	1890.	1891.	1892.	1893.
Falls of ground - - -	42	8	2	3	6	3	4	2	6	5	46	9	2	3	6	3	4	2	7	5
In Shafts.																				
Overwinding - - - - -	1	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—
Ropes and chains breaking -	1	—	—	1	—	—	1	—	—	—	2	—	—	1	—	—	2	—	—	—
Whilst ascending or descending by machinery - -	2	—	—	—	—	2	—	—	—	—	2	—	—	—	—	2	—	—	—	—
Falling into shaft from surface -	2	—	—	—	—	—	—	—	—	—	2	—	—	—	—	—	—	—	—	—
Things falling from surface -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Falling from part way down -	19	—	—	1	—	—	1	1	1	2	19	—	—	1	—	—	1	1	1	2
Things falling from part way down	7	1	—	—	—	—	—	—	1	—	7	1	—	—	—	—	—	—	2	—
Miscellaneous in shafts - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total in shafts - -	32	1	—	2	—	2	2	1	2	2	33	1	—	2	—	2	3	1	3	2
Miscellaneous Underground.																				
Explosions of gunpowder, &c. -	31	—	2	1	1	—	—	1	—	3	35	—	2	1	1	—	—	1	—	3
Suffocation by gases - -	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Irruptions of water - - -	—	1	—	—	—	—	1	—	—	—	—	3	—	—	—	—	3	—	—	—
Falling into water - -	—	—	1	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—
On inclined planes - - -	—	1	—	1	—	1	1	1	—	1	—	1	—	1	—	1	3	1	—	1
By trams and tubs - - -	1	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—
By machinery underground -	3	1	1	—	1	1	—	—	—	—	4	1	1	—	1	1	—	—	—	—
Sundries underground - -	36	1	1	1	2	2	1	2	2	1	37	1	1	1	6	2	1	2	2	1
Total miscellaneous underground	71	4	5	3	4	4	3	4	2	5	77	6	5	3	8	4	7	4	2	5
On Surface.																				
By machinery on surface -	13	2	—	—	1	1	1	—	1	—	13	2	—	—	1	1	1	—	1	—
Boilers bursting - - -	1	—	—	—	—	—	—	—	—	—	4	—	—	—	—	—	—	—	—	—
Miscellaneous on surface -	19	1	2	—	1	1	1	—	1	—	21	1	2	—	1	1	1	—	1	—
Total on surface - -	33	3	2	—	2	2	2	—	2	—	38	3	2	—	2	2	2	—	2	—
Gross total - - -	178	16	9	8	12	11	11	7	12	12	194	19	9	8	16	11	16	7	14	12

* In 1873 and 1874 the accidents in slate mines were not included, and for that reason the statistics for those years are not added to the table. In 1892 Shropshire was removed from the district, and Kent, Middlesex, Surrey, and Sussex were added to it.

The following tables are given, as usual, for the purpose of affording a comparison between the dangers of slate mines and those of other mines :—

Table showing the Death-rate from Accidents at the Mines in Dr. C. Le Neve Foster's District.

Year.	Persons employed.			Number of Deaths from Accidents.			Death-rate from Accidents per 1,000 Persons employed.		
	Under-ground.	Above Ground.	Total.	Under-ground.	Above Ground.	Total.	Under-ground.	Above Ground.	Total.
Copper, Lead, Zinc, and other Mines, exclusive of the Slate Mines.									
*Averages for the 10 years 1875 to 1884.	4,684	3,002	7,686	8·4	1·2	9·6	1·79	0·40	1·24
1885 - - - -	2,322	1,653	3,975	8	1	9	3·44	0·60	2·26
1886 - - -	2,634	1,882	4,516	1	—	1	0·37	—	0·22
1887 - - - -	2,628	2,075	4,703	3	—	3	1·14	—	0·63
1888 - - -	2,913	2,239	5,152	3	2	5	1·02	0·89	0·97
1889 - - - -	3,097	2,505	5,602	2	—	2	0·64	—	0·35
1890 - - - -	2,966	2,377	5,343	7	2	9	2·36	0·84	1·68
1891 - - - -	2,861	2,165	5,026	2	—	2	0·70	—	0·40
1892 - - -	2,383	1,887	4,270	5	1	6	2·09	0·53	1·40
1893 - - - -	1,845	1,508	3,353	6	—	6	3·25	—	1·79
Slate Mines.									
*Averages for the 10 years 1875 to 1884.	2,248	2,481	4,729	7·2	2·6	9·8	3·20	1·04	2·07
1885 - - -	2,404	2,414	4,818	8	2	10	3·32	0·82	2·07
1886 - - - -	2,263	2,361	4,624	6	2	8	2·65	0·84	1·73
1887 - - -	2,224	2,412	4,636	5	—	5	2·24	—	1·07
1888 - - - -	2,119	2,451	4,570	11	—	11	5·19	—	2·40
1889 - - -	2,155	2,315	4,470	7	2	9	3·24	0·86	2·01
1890 - - - -	2,252	2,173	4,425	7	—	7	3·10	—	1·58
1891 - - - -	1,939	1,999	3,938	5	—	5	2·58	—	1·27
1892 - -	2,084	1,959	4,043	7	1	8	3·36	0·51	1·97
1893 - - - -	2,146	2,259	4,405	6	—	6	2·79	—	1·36
Totals for all the Mines.									
*Averages for the 10 years 1875 to 1884.	6,932	5,483	12,415	15·6	3·8	19·4	2·25	0·69	1·56
1885 - - -	4,726	4,067	8,793	16	3	19	3·38	0·73	2·16
1886 - - - -	4,897	4,243	9,140	7	2	9	1·42	0·47	0·98
1887 - - -	4,852	4,487	9,339	8	—	8	1·64	—	0·85
1888 - - -	5,032	4,690	9,722	14	2	16	2·78	0·42	1·64
1889 - - - -	5,252	4,820	10,072	9	2	11	1·71	0·41	1·09
1890 - - - -	5,218	4,550	9,768	14	2	16	2·68	0·44	1·63
1891 - - - -	4,800	4,164	8,964	7	—	7	1·46	—	0·78
1892 - - -	4,467	3,846	8,313	12	2	14	2·68	0·52	1·68
1893 - - -	3,991	3,767	7,758	12	—	12	3·00	—	1·54

* The details for each of the 10 years will be found in the "Reports of the Inspectors of Mines for the year 1884," p. 206.

The general results for 1893 may be summed up as follows: The death-rate from accidents at ore mines, 1·79 per 1,000, was higher than it has been since 1885; the death-rate at slate mines, 1·36 per 1,000, was lower than usual; and the general death-rate for the district 1·54 per 1,000, was not so favourable as the average of the preceding eight years.

The accidents are described with sufficient fulness in the general list, and require no further remark, save that in one case there appeared sufficient neglect on the part of the manager to warrant a prosecution. The proceedings are described in the next chapter.

The severity of a non-fatal accident may be gauged by the period of disablement, or length of time the injured person was prevented from resuming work. The results of the figures given in the general list may be summed up as follows:—

NON-FATAL ACCIDENTS REPORTED IN 1893.

Period of disablement.	Number of Persons injured.	Percentage of the total Number.
1 week or less	3	4·6
1 to 2 weeks	4	6·2
2 weeks to 1 month	17	26.2
1 month to 3 months	18	27·7
3 months to 6 months	10	15·4
More than 6 months	10	15·4
Uncertain, but exceeding 3 months	1	1·5
Permanent disablement from following ordinary occupation.	2	3·0
	65	100.

It is evident that on the whole the injuries were by no means trifling; 89 per cent. necessitated an absence exceeding a fortnight, whilst in 35 per cent. of the cases the incapacity for work lasted more than 3 months.

CHAPTER IV.—Prosecutions: HOLWAY UNITED, MAEN OFFEREN, PENTRE HALKYN. Proceedings against workmen.

I think the prosecutions instituted by me in 1892 have had a salutary effect, for the list of cases brought before magistrates last year is a very short one.

Prosecutions in 1893.

Name and Description of Mine.	Name and Description of Offender.	Section of 35 & 36 Vict. c. 77 infringed.	Result of Hearing.	Penalty.	Costs.
				£ s. d.	£ s. d.
Holway United (*Lead*)	Holway United Mines, Limited (owners), and Alfred Thomas (liquidator).	Section 13	Conviction	7 10 0	7 10 0
	Maen Offeren Slate Quarry Co., Limited (owners).	Section 23 (3)	Conviction	0 2 6	0 10 9
Maen Offeren (*Slate*)	Griffith E. Jones	Section 23 (3)	Conviction	0 2 6	0 10 9
Pentre Halkyn (*Lead*)	John Hewitt (owner)	Section 23 (7)	Conviction	0 10 0	1 18 6
		Section 23 (10)	Conviction	0 10 0	
		Section 23 (10)	Conviction	0 10 0	
		Section 23 (14)	Conviction	0 10 0	
	Edwin Harper (agent)	Section 23 (7)	Conviction	0 10 0	1 18 6
		Section 23 (10)	Conviction	0 10 0	
		Section 23 (10)	Conviction	0 10 0	
		Section 23 (14)	Conviction	0 10 0	
			Totals	11 15 0	12 8 6

Holway United.—Some liquidators fail to realize that one of their duties is to erect secure fences to the shafts of mines under their control, and Mr. Alfred Thomas, no novice in mining matters, had to learn this lesson before the Holywell Justices. Though promising immediate compliance with my notices to fence shafts, he let month after month elapse without doing anything. When I found that no reliance could be placed upon his professions, I asked your permission to take legal proceedings against him, and I consider that he thoroughly deserved the fines inflicted upon him for his gross and deliberate neglect.

Maen Offeren.—In the month of March last year a man was killed upon an incline by stones from a runaway truck, which rushed down violently owing to a chain breaking. Proceedings were instituted against the owner and agent of the mine for nelgecting to provide a proper manhole.

At the time of the accident, the deceased was employed in blasting away part of the floor of the incline by the side of the line of rails; and his body was found immediately opposite an imperfect manhole, which might possibly have prevented the loss of life if it had been properly made. The manhole was insufficient because it was situated 3 feet above the level of the incline, and was therefore not easily accessible. Two months before the accident it was all right, because it was flush with the floor of the incline; but after the lowering of the floor, it could only be entered by climbing up 3 feet. A step of this kind rendered the manhole wholly inadequate to afford an easy refuge in a case of emergency.

In my opinion, the agent, Mr. Griffith E. Jones, was to blame, for two reasons: (1) Neglecting to make the manhole convenient, and (2) unnecessarily putting a man in a dangerous place. I have no hesitation in stigmatising his conduct in this matter as unfeeling, and I consider that he showed a lack of that care for the lives of others which should be a characteristic of every employer. Carried on at night in the absence of any traffic, the work would have been in no way dangerous; but Mr. Griffith E. Jones could give no reason for deliberately exposing his men to a needless risk. This want of forethought on his part could not be made a subject of complaint before the justices, who had simply to decide whether or no the manhole was sufficient within the meaning of the Act.

Pentre Halkyn.—The object of the proceedings was to secure more complete obedience with the Act than seemed possible by mere notices.

In July 1892, I made a complaint that a working shaft was not kept properly fenced, and in October of the same year I had to repeat it. My notices in writing failed to convince the agent that efficient protection had to be provided at all times, for on visiting the mine during the dinner hour last September, I found the shaft left unfenced. As it is only about a dozen yards from the high road, there was danger not only to the persons employed, but also to children living in the adjoining hamlet. The agent was well aware that he was acting illegally by raising and lowering persons in a shaft 72 yards deep without guides, and by neglecting to provide a signal down the shaft and a proper indicator.

Two of the prosecutions were conducted by Mr. J. P. Cartwright, solicitor, of Chester, and one by Mr. R. Mostyn Roberts, solicitor, of Carnarvon.

Prosecution of workmen.—I have heard of the following legal proceedings instituted by the agents of mines against their workpeople for breaches of the Special Rules.

No. of workmen prosecuted.	Nature of Offence.	Fine.	Costs.
		s. d.	s. d.
2	Returning too soon to a shot which had missed fire	1 0	9 0
1	Using an iron tamper	1 0	9 0
1	Not giving sufficient warning when firing a shot	5 0	5 0
1	Illegally unramming a charge which had missed fire	2 6	10 0
1	" " " "	2 6	11 0
1	" " " "	2 6	10 0

CHAPTER V.—GENERAL REMARKS: SPECIAL RULES. EXEMPTIONS UNDER THE SLATE MINES (GUNPOWDER) ACT. ABANDONED MINES. NEW MINES. UNREPORTED ACCIDENTS. SUMMARY OF WORK.

Special Rules.—Codes of rules drawn up for mines holding exemptions under the Slate Mines (Gunpowder) Act are in force at the Llechwedd, New Welsh Slate, and Oakeley mines.

The rules at Aberllefenny mine are somewhat different, as the men do not want the kegs of powder in the underground workings.

Special Rules are also in force at the following mines:—

Minera. Rules established in 1876. *See* Reports of H.M. Inspectors of Mines for 1876, p. 260.

Tan-y-bwlch. Rules established 9 July 1878. *See* Reports of H.M. Inspectors of Mines for 1878, p. 463.

Braichgoch, Bryneglwys, Bwlch-y-Slater, Cwmorthin, Cymerau, Diphwys Casson, Gaewern, Minllyn (formerly Carlyle), Moelferna, New Conglog, Park, Penarth, Ratgoed, Rhiwbach, Rhosydd, Voelgron, Votty and Bowydd, Wrysgan. *See* Reports of H.M. Inspectors of Mines for 1878, p. 460.

This code of rules was established at Rhiwgoch in January 1889. At Maen Offeren the code is slightly different, as will be seen by reference to p. 462 of the Report just quoted.

Additional Special Rules were established at Bryneglwys in June 1882.

In January 1887 Special Rules were established at the Artro, Diphwys, Hafotty, Harlech, and Moelfre manganese mines, which then belonged to the Dyffryn Mining Company.

Exemptions under Slate Mines (Gunpowder) Act.—In accordance with section 2 (4) of the Slate Mines (Gunpowder) Act, 1882, I have the honour to report that last year there were four slate mines holding exemptions from section 23 (2) (*a*), (*b*), and (*c*), of the Metalliferous Mines Regulation Act, 1872, viz., Aberllefenny, Llechwedd, New Welsh Slate, and Oakeley.

Abandoned Mines.—I have removed from my list the names of the following mines, which are, or appear to be, finally abandoned :—

Cardiganshire: Bwlchgwyn, Crown, Esgairlle, Great West Van, Powell, Red Rock.

Carnarvonshire: Gorsedd, North Cyffty.

Denbighshire: Llanganhafal, Maes-y-safn.

Flintshire: Bryn-yr-hanblas, Garneddwen, Garth, Grange, Holywell Silver Lead, North Pant-y-ne, Parrys, Rhydwen, Rock, Sir Edward.

Merionethshire: Barmouth, Blende or Moel, Ispri No. 1, Caerbendy, Crib ddu, Cwm-mynach, Cynfal, Dduallt, Gamallt, Garllwyn, Mignent, Moelfre, Moel Ispri No. 2, Prince of Wales, Sett fach, Sygun.

Montgomeryshire: Cwm Rhaiadr.

New Mines.—Work has been resumed at the following old mines :

Denbighshire: True Blue.

Flintshire: Halkyn Hall, Hersedd, Saithaelwyd.

Merionethshire: Croes-y-ddwy-afon, Crown.

Unreported Accidents.—I had to complain at the New Welsh Slate mine of lack of care in reporting non-fatal accidents. The accident to Simeon Jones, No. 29, came to my knowledge in an indirect manner, long after its occurrence. Considering that the young man was laid up for six weeks, I think it ought to have been notified to me by the manager; but, strange to say the first news he received of the accident was through me. This fact of itself proves that his supervision was decidedly lax. The other accident, No. 30, caused an absence from work of three weeks, and should not have remained unreported. However, looking at all the facts of the case, I did not feel that I should be justified in asking your permission to take legal proceedings against him for his neglect. If one puts oneself in the manager's position, it must be admitted that it is occasionally difficult at first to decide whether an accident should be reported to the inspector or not. The Act specifies that accidents causing " serious personal injury " shall be notified. In the case of Simeon Jones, no bones were broken, the lad's leg was squeezed, and his trousers were torn. I can quite understand that the foreman might have thought that the lad would be back in his place in a few days. The same may be said with the case of Griffith Griffiths. A piece of slate fell upon his toe, and injured him so slightly that he is said to have returned to work the following day. His toe then began to pain him, and he stopped away three weeks. At first sight the accident did not in any way appear grave, and there is an allowable difference of opinion as to what is intended in the statute by the word " serious." It is evident that no uniformity in the system of reporting non-fatal accidents will be attained until a statute defines more clearly what is required.

Summary of Work.—In addition to carrying on the current work of my district, I was obliged to devote much of my time to meetings of the Open Quarries Departmental Committee, of which I was a member, and to visits to quarries in various parts of the kingdom. In the month of December, the Merionethshire Slate Mines Committee, of which I am chairman, began its sittings; it is still continuing its labours.

During the year I travelled 9,741 miles upon official business, viz, 8,592 by rail, 474 by sea, and 675 by road.

I have, &c.
C. LE NEVE FOSTER.

The Right Hon. H. H. Asquith, Q.C., M.P.,
Her Majesty's Principal Secretary of State,
Home Department, Whitehall, London.

REPORT

OF

THOMAS BELL, Esq., H.M. INSPECTOR OF MINES

FOR THE

DURHAM DISTRICT (No. 4),

TO

HER MAJESTY'S SECRETARY OF STATE,

UNDER

The Coal Mines Regulation Act, 1887, the Metalliferous Mines Regulation Acts, 1872 and 1875, and the Slate Mines (Gunpowder) Act, 1882;

For the Year 1893.

Presented to both Houses of Parliament by Command of Her Majesty.

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Mr. Bell's Report.

Report on the Inspection of Mines in the Durham District, comprising the southern part of the county of Durham, the county of Westmoreland, and the North Riding of the county of York, under the Coal Mines Regulation Act, 1887; the Metalliferous Mines Regulation Acts, 1872 and 1875; with the Slate Mines (Gunpowder) Act, 1882; from the 1st day of January to the 31st day of December 1893 inclusive: By Thomas Bell, Esq.

Sir, Shamrock House, Durham, March 1894.

I have the honour to submit, for your information, as required by section 43 of the Coal Mines Regulation Act, 1887, and by section 20 of the Metalliferous Mines Regulation Act, 1872, my twenty-first Annual Report as Chief Inspector of Mines for the Durham Inspection District (No. 4), on the working of these Acts in South Durham, Westmoreland, and the North Riding of the county of York, for the year ending the 31st December 1893.

During the year I have been ably assisted, as heretofore, by Mr. William Walker, of Durham, and Mr. John Plummer, of Bishop Auckland, Assistant Inspectors of Mines, whose reports, as required under the Metalliferous Mines Act, are herewith enclosed.

My official duties have fully occupied me the whole of the year (save for a month when I took a holiday), necessitating my travelling and being from home on 266 days and 30 nights. During that time I travelled 8,552 miles by railway and 3,151 miles by road, or a total distance of 11,703 miles.

All the correspondence has, as usual, passed through my hands and been attended to; much of it had to be done at nights on my return home from official visits. All the various requirements of the Acts have also been attended to, and all complaints received from the workmen, whether anonymous or otherwise, have been properly investigated. I have also attended several meetings of coal owners and workmen, in cases of dispute, and have been engaged at the Home Office, as a member of the Statistical Committee, in tabulating and arranging the mineral statistics of the United Kingdom.

Mr. Walker reports to me that he was on official duty on 297 days, visited 382 collieries, attended 43 inquests, and to seven complaints of workmen, made 197 underground inspections, and travelled 4,266 miles by rail, and 2,407 miles by road, or a total distance of 6,673 miles travelled in the performance of these duties during the year. He had 14 days' leave of absence.

Mr. Plummer reports that he was officially engaged on 299 days, visited 364 collieries and other mines, attended 41 inquests, and to six complaints made by the workmen, made 217 underground inspections, and travelled 6,596 miles by rail, 1,785 miles by road, or a total distance of 8,381 miles travelled in the performance of these duties. He had 14 days' leave of absence.

Jointly we made 862 visits to mines, 475 of which were underground, and 387 in connexion with work and inquiry above-ground; we attended 90 inquests and adjourned inquests, and several other attendances were at solicitors' offices, Examination Board, and other meetings incidental to the multifarious duties devolving on an Inspector of Mines.

The total number of miles travelled jointly in the performance of inspection duties in the district during the year was 26,757.

The tables of statistics made out by H.M. Inspectors of Mines to accompany their Annual Reports for the year 1893 are herewith attached, and the following is a condensed summary:—

Part I. contains all the facts relating to persons employed, minerals raised, and fatal accidents for the year 1893.

Table No. 1 shows that, during the year 1893, the total number of persons employed in and about all the mines in the United Kingdom of Great Britain and Ireland, together with the Isle of Man, amounted to 718,747, of whom 5,450 were females working above-ground, the tonnage of minerals raised under the Coal Mines Regulation Act, and the number of mines at work.

Table No. 2 shows that, during the year 1893, the total number of persons employed in and about the mines under the Coal Mines Regulation Act, arranged in districts and according to age and sex, was 683,008, of whom 4,725 were females working above-ground, the aggregate increase being 634 compared with the preceding year.

Table No. 3 shows that the number of persons employed in the mines under the Metalliferous Mines Regulation Acts, arranged in districts and according to age and sex, was 35,739, of whom 1,035 were females working above-ground, being a decrease of 2,427 compared with the preceding year.

Table No. 4 shows the quantities and kinds of minerals raised in the different districts under the Coal Mines Regulation Act, the total quantity being 175,236,857 tons, of which 164,325,795 was coal and 6,560,189 ironstone, the rest being fire-clay, oil shale, and other minerals, making a total decrease of 16,718,051 tons compared with the preceding year, there being a decrease of 17,461,076 tons of coal and an increase of 915,703 tons of ironstone.

Table No. 5 shows the quantities and kinds of mineral raised in the different districts under the Metalliferous Mines Regulation Acts, the total quantity being 3,770,991 tons; of which 2,356,616 tons was iron ore, 40,292 tons lead ore, and 160,363 tons tin ore.

Table No. 6 shows the number of fatal accidents under the Coal Mines Regulation Act, which was 809, arranged according to causes and in districts, being a decrease of 38 compared with the preceding year.

Table No. 7 shows the number of deaths from the above-mentioned accidents, which was 1,060, being an increase of 44 compared with the preceding year.

Tables Nos. 8 and 9 are precisely similar tables under the Metalliferous Mines Regulation Acts to Tables Nos. 6 and 7, and show the number of fatal accidents was 39, and the number of deaths resulting therefrom was 65, being a decrease of nine accidents, and an increase of 13 deaths.

Tables Nos. 10 and 11 show the hours of the shifts in which the fatal accidents happened under both Acts.

Tables Nos. 12 and 13 show the ratios of deaths from accidents per 1,000 persons employed under both Acts, and also per 1,000,000 tons of mineral raised under the Coal Mines Regulation Act. The ratio of deaths per 1,000 persons employed underground under the Coal Mines Regulation Act was 1·709 as compared with 2·919 in mines under the Metalliferous Mines Regulation Acts, whilst 6·043 persons lost their lives for every 1,000,000 tons of mineral raised under the Coal Mines Regulation Act.

Part II. contains all the facts relating to persons employed, minerals raised, and fatal accidents, for every year from 1873, for purposes of comparison.

Table No. 14 shows that whereas in 1873 the number of persons employed in and about all the mines of the United Kingdom was 576,832, this number had *increased* in the year 1893 to 718,747.

Table No. 15 shows that whereas in 1873 the number of persons employed in and about the mines under the Coal Mines Regulation Act was 514,149 this number had *increased* in the year 1893 to 683,008.

Table No. 16 shows that whereas in 1873 the number of persons employed in and about the mines under the Metalliferous Mines Regulation Acts was 62,683, this number had *decreased* in the year 1893 to 35,739.

Table No. 17 shows the production of all minerals classed under the Coal Mines Regulation Act during the year 1873 amounted to 143,041,246 tons, that it *increased* up to the year 1891, when it reached a total of 197,693,592 tons, and that it has since *decreased*, until 1893 it was 175,236,857 tons, this decrease being principally caused by the labour dispute which existed in several districts during four months of the year.

Table No. 18 shows the quantities of minerals wrought under the Metalliferous Mines Regulation Acts, including the minerals wrought from open workings not comprised within the Acts since the year 1873.

Table No. 19 shows that the number of deaths from accidents under the Coal Mines Regulation Act in the year 1873 amounted to 1,069, and in 1893 to 1,060, but the persons employed during the former year were 514,149, and in the latter year 683,008, whilst—

Table No. 20 shows that the number of deaths from accidents under the Metalliferous Mines Regulation Acts in the year 1873 amounted to 104, and 1893 to 65, but the persons employed during the former year were 62,683 and in the latter year 35,739, whilst—

Table No. 21 shows that 2·079 deaths occurred from accidents to 1,000 persons employed during the year 1373, but that in the year 1893 the proportion had *decreased* to 1·552.

Table No. 22 shows that 1·659 deaths occurred from accidents to 1,000 persons employed during the year 1873, but that in the year 1893 the proportion had increased to 1·781.

Persons Employed.

Durham District.

There were 53,510 persons employed underground in the coal mines during the year, being an increase of 1,088, 4,220 of them being boys under 16 years of age. There were also 12,881 persons employed on the surface, being an increase of 14, five of them being females and 1,756 boys under 16 years of age, or a total of 66,391 persons employed in and about the coal mines during the year, being an increase of 1,102 as compared with the previous year.

There were 4,161 persons employed underground in the Cleveland Stratified Ironstone Mines, 164 of them being boys under 16 years of age. 1,065 persons were employed on the surface, including 48 boys under 16 years of age, showing a decrease of 235 persons employed underground, and an increase of 52 on the surface, and making a total of 5,226 persons employed in and about these mines during the year, or a decrease of 183 as compared with the previous year.

There were therefore 57,671 persons employed underground and 13,946 above ground, or, in the aggregate, 71,617 persons employed in the district under the Coal Mines Regulation Act. This shows a net increase of 919 persons employed as compared with the year 1892.

The Metalliferous Mines of the district employed 1,206 underground, 10 of them being boys under 16 years of age, showing a decrease of 33 persons; there were 683 persons employed on the surface, 193 being boys under 18 years of age, and 36 less than the previous year, or, in the aggregate, 69 fewer persons employed at these mines than during the preceding year.

There were also 42 persons employed about open metalliferous works in the district, or seven less than in the year 1892.

Under the summary (C.) there were employed on private branch railways and tramways, and in washing and coking coal on premises adjacent to or belonging to the mines, during the year, 4,816 persons, of whom five were females, and 148 boys under 16 years of age, being a decrease in the aggregate of 86 persons as compared with last year. These persons do not come under the Mining Acts, and the information was originally collected for statistical purposes, but under the new summaries issued by the Home Office they are, for the first time, now included in the total number of persons employed in and about the mines, and are of course used in the calculations of ratios of deaths to the persons employed, which is misleading when comparisons are being made with previous years.

The Salt or Brine Wells, in the South Durham and Cleveland districts, employed 705 persons during the year, and produced 289,198 tons of white salt, being an increase of 124 in the number of persons employed and of 58,138 tons in the produce of salt. These works are not subject to any of the Mining Acts, but the owners voluntarily furnish me with the annual statement of persons employed, and salt produced, a courtesy I acknowledge with many thanks.

It therefore appears that there were employed in and about the mines, private branch railways, washing and coking coal on premises adjacent to or belonging to the mines, open metalliferous and salt works, during the year, as under :—

Heads.	Underground.	Above ground.	Total.
Coal Mines	53,510	12,881	66,391
Cleveland Ironstone Mines	4,161	1,065	5,226
Metalliferous Mines	1,206	683	1,889
Total under Mining Acts	58,877	14,629	73,506
Private Branch Railways, &c.	—	4,816	4,816
Metalliferous open Works	—	42	42
Salt and Brine Wells	—	705	705
Total number of persons employed in and about the Mines for 1893.	58,877	20,192	79,069
Total number of persons employed in and about the Mines for 1892.	58,057	20,131	78,188
Increase	820	61	881

MINERALS PRODUCED.

The total weight in statute tons of mineral produced in the Durham district from every source, for the year under notice, is as follows :—

Kind of Mineral.	Part of District.	Tons.	Tons.
Coal	South Durham	21,822,702	
,,	Westmoreland	1,113	
,,	Yorkshire, North Riding	3,974	
			21,827,789
Fireclay	South Durham	—	276,519
Ironstone	Cleveland	—	4,625,520
	Total under the Coal Mines Act	—	26,729,828
	Under the Metalliferous Mines Act.		
	County of Durham	10,733	
	,, Westmoreland	5,189	
	,, Yorkshire, North Riding	90,602	
			106,524
	Total	—	26,836,352
	Produced at Open Works.		
	County of Durham	4,113	
	,, Westmoreland	2,436	
	,, Yorkshire, North Riding	376	
			6,925
	Salt made from Brine.		
	County of Durham	241,020	
	,, Yorkshire, North Riding	48,178	
			289,198
	Gross Mineral produce for the district	—	27,132,475

showing an increase in the production of mineral as compared with the previous year of—

Kind of Mineral.	Tons.	Tons.
Coal	4,862,759	
Fireclay	97,343	
Ironstone	1,214,120	
Metalliferous Produce	12,637	
Mineral from Open Works	547	
Salt from Brine	58,138	
Making the total increase of the year for the district	—	6,245,544

SUMMARY OF ACCIDENTS AND DEATHS.

During the year I have received notice of 481 accidents from the Coal Mines, 63 of them being fatal, causing 67 deaths, the ratio being one fatal accident to 1,054 and one death to every 990 persons employed in and about the mines, and one fatal accident to 350,862, and one person killed to every 329,915 tons of mineral raised.

From the Cleveland Ironstone Mines I have received 84 notices of accident, nine of them being fatal, causing the same number of deaths, the ratio being one fatal accident and one death to every 580 persons employed in and about the mines, and one fatal accident and one person killed to every 513,947 tons of mineral raised.

The average for the whole kingdom being one life lost for every 644 persons employed, and one death for every 165,318 tons of mineral raised.

There have been no deaths, and I have received only four notices of personal injury occurring at the Metalliferous Mines.

During the year 4,816 persons have been employed on private branch railways and tramways, and in washing and coking coal on premises adjacent to or belonging to the mines, and from these I have received notice of four deaths as having occurred; three of them on private branch railways and one at a coal-washing machine, being a ratio of one life lost to every 1,204 persons employed. Thus showing the result to be a loss of 80 lives as compared with 58 during the year 1892, being an increase of 22 in the number of the lives lost at the mines under the Mining Acts, and on private branch railways and tramways, and in washing and coking coal on premises adjacent to or belonging to the mines.

Nineteen deaths have been reported to me during the year as having taken place in and about the mines of the district; but, on investigation, it was found they were not caused by accidents on works comprised within the Mining Acts. Details will be found in Schedule H.

I have received reports of one death, and various personal injuries to 10 other persons in the coal mines, and of two deaths and serious injuries to eight other persons in the Cleveland Ironstone Mines caused by the use of gunpowder. These accidents are chiefly due to the workmen's impatience, and returning to supposed missed shots before the fuse has had time to run up to the charge.

There have also been two accidents causing personal injury to as many workmen in the metalliferous mines. One of them inserted a pricker into a charge of unexploded blasting gelatine which exploded the detonator; the result was an injury to his eye, and one finger was blown off. The other man received serious injuries by lighting the exploding squib instead of the match, thereby causing the shot to go off before he could get away from it.

DETAILS OF DEATHS CAUSED BY FATAL ACCIDENTS.

1. *Explosions of Gas.*—There has not been a fatal accident from this cause in the Durham district since the year 1886 until the year under notice, when two men have been killed, and I have received notice of six other accidents causing slight personal injuries to eight men. The non-fatal cases have occurred at collieries in the west part of the district where open lights are used, and where gas has seldom, if ever, been seen.

The two fatal cases also occurred in the western part of the district at collieries where gas has never been known to exist. The first, which is No. 28 on the list, occurred about 9 o'clock a.m. on the 30th June last at the Butterknowle Colliery, near to Cockfield Fell, causing the death of Joseph Tarn, a coal hewer.

On the day in question the competent person appointed under No. 4 General Rule, on making the examination before the commencement of the shift, found that fire-damp was present in deceased's place, and he, in consequence, fenced it across its whole width, hung a caution board that no naked lights were to pass that point on any pretext whatever, and on the outbye side of this he placed a baulk, and chalked DANGER on it.

At the meeting station he told deceased, in the presence of the other men, that he could not go into his place because there was gas in it, and deceased replied that he wanted to as he had left two picks in the day before. He was again told he must not do so.

About an hour and a half afterwards the deputy heard a sound like a fall, and at once went towards the place from which it proceeded, and in doing so met deceased coming out of the place he had been forbidden to go into; he had no light, and at the time said he had not taken a light beyond the caution, but afterwards, on an examination being made by the overman and deputy, his lamp was found some distance on the inbye side of the caution board and fence. Deceased was burnt about the face, arms, and chest, and succumbed to the injuries on the 10th of July.

The lamp deceased had was an open one, safety lamps not being used in this mine. The place was a rise "bord," and 60 yards past the last holing. The proper course to have adopted when the presence of gas was first detected would have been to have had it removed by putting brattice in, but this was not done; the reason, as given by the manager, under manager, and deputy, was that the roof was bad, and it was thought best to wait until the "wall" had holed close to the face of the place in which the explosion occurred. This holing was expected to be made in the course of a shift or so.

The deceased man was, however, altogether responsible for the accident himself. I cannot for one moment comprehend how a man can be so foolhardy, and especially so after he had been warned he must not do so, as to deliberately take a naked light and walk past caution boards and fences into a place which he had been told contained gas. It can only be complete ignorance of the danger run, and a contempt for all rules and regulations that can make such a thing possible.

The second case, which is No. 59 on the list, occurred about 10.15 o'clock a.m., on the 8th of December last, at the Wooley Colliery, near Tow Law, both in the county of Durham, causing the death of Hilton Humes, also a coal hewer.

Between 2 and 4 o'clock a.m. the place where this accident occurred was examined, by the competent person appointed under the general and special rules, for the purpose, before the commencement of the shift, and was reported to be in a safe condition, and free from noxious or inflammable gas.

The man who should have worked in the place during that shift did not come, and, consequently, no one was in it.

The place was examined at 8.30 a.m., again by the same person, to prepare for the second shift, and was, as before, found to be in a safe working condition.

At 9.30 the second shift of men went down the pit, and after being met by the deputy were sent to their respective places. As soon as deceased got into his some gas lit up at his candle, and so severely burnt him that he died three days afterwards.

This seam has, since its commencement, been worked with candles, but safety lamps will now be substituted.

The ventilation at the time of this explosion was in its normal condition, and there were no dislocations of the strata near the place. There were, however, some rolls, or horse backs, in its vicinity, and at the time of the explosion the barometer was very low; these are the only causes I can suggest for the presence of inflammable gas.

2. *Falls in the Mine.*—The number of deaths caused by falls of roof and side in the coal mines were 34, which is eight more than last year, and is the average of the preceding five years. The deaths from this cause in the Cleveland Ironstone Mines have been five, or one less than last year, and also one less than the average for the preceding five years.

I wish again to call the serious attention of colliery managers to the great loss of life in mines by falls of roof and sides. By a perusal of the tables it will be seen that the number of accidents and deaths from this cause is about one-half of the total number of fatalities in this district. No doubt many of these accidents might have been averted by more care on the part of the victims themselves and more strict discipline on the part of those in charge of the work.

The use of sprags or holing props ought to be made compulsory, whether actually required or not. The miners, as a rule, are very careless in the use of these supports, and numerous cases of personal injury as well as deaths are the result. I also think it desirable to make it compulsory that the certificated manager should specify a distance which should not be exceeded in the fixing of props and bars in the different working places under his charge.

Number 19 on the list occurred at Croxdale Colliery, belonging to the Weardale Iron Company, Limited, on the 1st of May, about 4 o'clock p.m., causing the death of William Curry, a coal hewer.

Deceased was assisting a deputy to draw, and while doing so a large stone fell from a breaker, which the deputy had not seen, and killed him on the spot.

This stone, directly the deputy knocked out the timber supporting it, would fall without the slightest warning, and there would be no chance of escape. I understand the deputy was a careful and experienced man.

Timber drawing is a hazardous occupation, and too much care cannot be exercised while following it.

Number 20 on the list occurred at West Auckland Colliery, belonging to Messrs. Bolckon, Vaughan, and Company, Limited, on the 3rd of May, about 6 o'clock p.m., causing the death of James Halfpenny, a deputy.

This accident occurred while he and another deputy were drawing a jud. The evidence at the inquest, given by the deputy who was with deceased, was as follows:—

"I am a deputy at West Auckland Colliery. I had been drawing in my own " district on the afternoon of the accident, and I had finished there, and went to assist " Halfpenny. He was taking timber out of a jud about 9 yards long by 6 yards wide, " and rising about 9 inches to the yard. I had only been with deceased five or ten " minutes when the accident happened. He attempted to cut a prop in the middle, and " when he struck the first blow the fall took place with a rush, and completely buried " him, so much so that it took five hours to get him out from under the fall. I never " saw a jud fall so suddenly in my experience before."

There was nothing to see when the place was inspected after the accident, except the hole from which deceased was taken out.

I think it was an accident which could not have been prevented or foreseen. The cutting of the prop in the middle was wrong. In taking timber out the props should always be cut at the top. Cutting them in the middle is a very dangerous practice.

Number 29 on the list occurred at Sherburn House Colliery on the 7th of July, about 2 o'clock a.m., causing the death of Robert William Dixon, a putter.

I cannot better explain this accident than by quoting the evidence given at the inquest by another putter who was working along with deceased at the time of the accident. He said: "I went to work with deceased on the night of the accident, and " the deputy set us to hew, after we had finished putting, in a place called the " Whinney Way, in the Low Main Seam, to complete our shift. We went to this " place and tried it, but we thought it was too hard, so we took our picks to a place " at the back of the shaft, where a man was taking up bottom stone, and commenced " to hew there. The man told us to come out of the place, but we told him we would " not do so. We left our coals lying loose, and then went to a place right opposite, " where we hewed and filled about three parts of a tub. We then went back to the place " we had left the coals in, and cast the coals past the bottom cutter. Deceased then said " 'There is some coal by the side seven or eight yards away, which can be easily " 'hewed.' I replied that it was easily got in this place, and we might make our last " tub out there, but he said 'The other place is softer,' so I said all right, we will go. " We had only struck a few blows when the stone fell and caught him. He was got " out as soon as possible and taken home. The place where the accident occurred is " about 400 yards off where we were sent to by the deputy. We are not allowed to go " anywhere we like. The deputy had been in the place which we should have gone to

" before he told us to go to it. The night shift deputy ascends the shaft at 11 o'clock " p.m., and the fore shift deputy comes down at 2 a.m. The master shifter has charge " of us between these times. We know perfectly well that, in doing what we did, we " were wrong, and that it was highly dangerous."

The place where the accident occurred is in between two faults, owing to the presence of which the coal is much softer than it is in the ordinary working places, and this no doubt accounts for the two lads leaving the place they were sent to by the deputy. It was a very reprehensible proceeding to take, and which, in doing, they contravened Special Rule No. 91 of No. 3 Rules, which reads as follows:—" No work-" man or boy shall, unless and until authorised, go beyond the appointed meeting " station, or any fence, danger board, or recognised signal, nor, except in case of " necessity, into any other part of the mine than that in which he is placed by the " overman, deputy, or other official."

Accidents of this kind occur too frequently as it is, but they would be much more numerous if the workmen and boys were allowed to go about any part of the mine, when and how they think fit, to work coal wherever they thought it was easiest to do so.

The discipline of the mine cannot be too strict to prevent contravention of the Act and Special Rules, and highly dangerous practices. In this particular case there was no deputy in the seam to look after these and other putters who were hewing at the time of the accident; they were in charge of the master shifter, who also had duties in another seam. On my making representations to the management an extra deputy was employed.

Number 36 on the list also occurred at Sherburn House Colliery on the 8th of August, about 10 o'clock a.m., causing the death of John Williamson, a coal hewer.

There was, I think, no carelessness or negligence on the part of anyone in this case, and I only mention it to draw attention to the treacherous character of stones of this shape and nature, and to point out how necessary it is that every care should be used in examining the stone, and in placing timber under it.

The stone which fell and killed this unfortunate man was 9 feet long × 6 feet wide × 1 foot thick, and would weigh about 3½ tons. The shape of it was that of a horse's back, and it was surrounded by slips on every side except one. It would, no doubt, when tried, sound all right, and, as it was supported by the coal, until a slip in the face of the place was disclosed, directly this support was worked away it would fall with little or no warning. Deceased's day's work would have been completed in about ten minutes if this fall had not taken place.

Number 38 on the list occurred at Croxdale Colliery on the 19th of August, about 4.30 o'clock a.m., causing the death of Charles Robinson and James Hunter, both coal hewers.

This accident was caused by a fall of stone which fell away from three slips, one at each side of it, and the other at the end next to the face of the coal.

It was only discovered, after the accident had occurred, that the two deceased men had taken out the timber which had been set to support this stone, although they had been told by one of the officials that it must not be removed, and by doing so lost their lives.

I have on many occasions, in my reports and when visiting collieries and mines, and attending inquests, drawn attention to the danger incurred by removing timber, and so have my assistants, but, notwithstanding, accidents caused by this reprehensible and dangerous practice still occur.

Number 40 on the list occurred at Sherburn House Colliery on the 19th September, about 8.40 o'clock, a.m., causing the death of William Spedding, a putter.

It transpired two more putters were employed at this colliery than were necessary, so that they might fill the places of any who were off work. On the day in question, all the putters were at work, and two of them, one being the deceased, were not required, so they were sent into a place to hew coal. They had made a jud, drilled, charged, and stemmed a shot hole, and while waiting for the deputy to come and fire the shot, the coal fell over on to deceased, killing him instantaneously.

It was the second lift of a broken jud, and the coal being soft and broken by the weight, it did not, in my opinion, require a shot to bring it down.

There was a very good supply of timber and also of sprags or jud props, but the latter unfortunately had not been used. The Special Rule, referring to the spragging of juds, states that "he (the hewer) shall sprag his jud *where necessary*," which would

meet this case, but I think it should be made to read " he shall *in all cases* sprag his jud," and then probably there would be fewer accidents of this nature to report each year.

Deceased was 17 years of age, and the other lad was even younger. It is, I think, a dangerous practice to allow youths of this age to hew alone, or together, for they cannot possibly have the experience and judgment necessary to work a place with safety. They should either be sent to work along with a hewer of experience or not allowed to work as coal getters at all. General Rule 39, of the Coal Mines' Regulation Act, did not prevent these putters working alone even, as coal or ironstone getters, in the face of the workings, as they had both been previously employed for more than two years in and about the face of the workings.

3. *Accidents in Shafts.*—The number of deaths caused by shaft accidents in the coal mines have been nine, which is five more than last year and about double the average of the preceding five years.

One man was killed by the breaking of a baulk of wood on which the cage was suspended while he was engaged cleaning some ice from the side of the shaft. Another fell out of the cage while he was ascending; he is supposed to have fainted. Another man stupidly put his head out of the cage, while it was in motion, and was crushed to death. Another, who failed to sprag some tubs while running towards the shaft, tried to stop them by going between them and was driven into the cage hole, and crushed to death. Another fell off the cage top while descending the shaft with some deals; the cage in this case was improperly fitted with guides, causing it to strike the side of the pit; and other four men were killed by the breaking of a winding rope.

There have been no shaft accidents reported from the Cleveland Ironstone Mines during the year.

Number 34 on the list occurred at Langley Park Colliery, on the 28th of July, about 11 o'clock a.m., causing the death of William Crossmore.

Deceased was ascending the shaft, along with other three men, in a cage in which they could stand upright. Just as the cage was leaving the bottom he reached out to knock a boy's cap off, and, in doing so, put his head over the bar, to which the snecks, to keep the tubs in the cage, are attached. Before he could get back his head was caught by a bunting, and he was so seriously injured that he died on the way to the hospital. The shaft was examined and found to be all right.

This accident should never have happened. While ascending or descending in cages is not the time for larking, and this poor old man, by indulging in it, was killed. I hope it will deter other men from doing the same thing.

Number 51 on the list occurred at Framwellgate Colliery on the 6th of November, about 5.30 o'clock a.m., causing the death of William Willis, a sinker.

The shaft in which this accident happened is situated about 1½ miles south of the main or coal-drawing shafts, and has only recently been sunk for the purposes of improving the ventilation, and to send the men to and from work, the faces of the working places being in its vicinity.

At the time of the accident the shaft was not quite complete. Two cages had been put in on the north and south sides respectively; they were single decked cages and carried two tubs end to end, the length of the cage being 9 feet 2½ inches over all.

The guides were of wire rope, and there were two to each cage, secured at the top and bottom of the shaft by screw bolts to timbers. They were both on the same side of the cage—that next to the shaft walling.

There were also two wire ropes from the top timbers and fastened at the bottom of the shaft to the same timbers as the guides and in a similar way, and they passed down the centre of the pit, but were not attached to the cages; they were simply put in to prevent the cages striking at meetings, where there was a clearance of nine inches.

The south cage was put in first, on the 2nd of November, and it was found that the corners next to the side of the shaft came within five and six inches of the walling respectively, while running in the shaft. The north cage was put in two days later, and both corners of it were six inches from the walling.

It was intended on the day of the accident to move the south cage round as it was running too near to the shaft side, and also to tighten the guide ropes, and I was told after the accident occurred that it had always been the intention of the management to put in two extra guide ropes to each cage, opposite to those on the outer sides, to pass through rings attached to the cages, and to secure them in the same way as the other guides. A plan was also produced, which showed this system, four guides to each cage, and it was stated to be the original plan.

Deceased, along with one or two other men, was employed to do the necessary work to complete this shaft.

On the morning of the day in question the engineer went down the shaft with deceased to show him some work which required to be done and for which he wanted some timber down the pit. Deceased, therefore, came to bank and got two deals, one 15 feet long × 7 inches × $1\frac{1}{4}$ inches, and the other the same size, except in length, and it was 9 or 10 feet long.

They were put on to the top of the south cage on their ends and secured to the cage chains by means of strong cord; he then got on beside them and another man inside of the cage.

The brakesman then lowered the cage gently down the shaft and very soon after it was heard to strike against something, and this was almost immediately followed by a rumbling noise. The cage was at once brought to the surface and it was found that the man was alright inside the cage, but that deceased had been thrown off the top into the shaft and precipitated to the bottom, a distance of 120 yards.

The man who was in the cage said at the inquest, "After the deals were put, and "Willis got on to the top of the cage, I got inside and we were lowered down very "gently and quite steadily. There was nothing wrong until we got to the water ring, "78 feet from the surface, when the bottom corner of the cage next to the walling "caught it and canted the cage over a little and then slipped off with a jerk. I then "heard deceased falling down the shaft. I shouted 'Hold' and the cage was then "drawn to bank."

This, I have no doubt, is the correct explanation of how the accident occurred.

In all my experience I have never known long cages like these with only two guide ropes, and where four rope guides are used I have never seen two ropes hanging between the cages, and I am inclined to think it was intended to try if two guides for each cage could be done without. I know it was intended, if this accident had not occurred, to send all the colliers, working in the districts near to, down this shaft on that day. It is fortunate that this was not done, or there might have been an accident causing much greater loss of life.

I made a careful examination of the shaft, and found the cages, in several places, were running too close to the shaft walling, and that with the two guides, I could make the cage swing in such a way as to cause it to go into the centre of the shaft and then come back and strike the walling.

Since this accident happened each cage has been fitted with four guides, and the clearance between the cages and the walling enlarged where necessary. Several other suggestions I made, to effect greater safety, have also been carried out.

No. 55 on the list occurred at the Fell Shaft of Burnhope Colliery on the 23rd of November, about 9.15 o'clock p.m., causing the deaths of the following four men, George Holt, a master shifter; Aaron Loycock, John Hall, and George Shaw, all shifters.

The workmen at this colliery are changed at this shaft, which is used for this purpose, pumping water, and winding a few tubs of coals each day for the boilers raising steam for the winding and pumping engines, and is situated about 400 yards east of the working or coal-drawing shafts.

The workmen who had been in the pit, during the day left about 5 p,m., and the shifters and stonemen were sent down at 8 p.m.

The shifters and stonemen numbered 32, and the cage carried four men at a time. Seven cages, or 28 men, had been safely lowered, but while lowering the eight, or last cage, the rope suddenly broke when the cage had got about 30 yards from the surface, and the four unfortunate men were dashed to the bottom of the pit, a distance of about 150 yards, and instantly killed.

The rope was of Lang's Patent lay principle and a compound one, the construction of which was, for the strand, one centre wire No. 20, B.W.G., round that wire five others of No. 17, B.W.G., which made the core, then eight wires came round this core of No. 14, B.W.G., and the whole composed the strand of 14 wires. There were six strands in the rope, or in all 84 wires. A hemp core was placed and the six strands laid round it. The rope was three inches in circumference, made from the highest quality of "Smith's plough steel" wire, and the cost was 63*s.* per cwt., the weight being 9 cwts. 1 qr. and 11 lbs., and the total cost 29*l.* 9*s.*

The breaking strain when new was 38 tons, and the safe working load, as guaranteed by the makers, was 76 cwts., or $\frac{1}{10}$th of the breaking strain, which is the

usual margin allowed by rope manufacturers. The working load in this case, when changing men only, including weight of cage, chains, and men, was 17 cwts., and the average time in use would be about 4½ hours every day.

5,496 tons of coal had been drawn by both ropes at this pit during the last four years, and when this was being done the working load was, including cage, chains, tub, and coal, 21½ cwts.

The rope was put on to the drum on the 2nd of November 1889, and had therefore been in use 4 years and 21 days. The companion rope on the same drum was put on on the 11th January 1890, and has therefore been in use 3 years, 10 months, and 12 days; it was also made on Lang's lay principle, but was not a compound rope, and only had half the number of wires in it, viz., 42.

The two ropes previously in use at this pit, working under precisely similar conditions, were in use 5 years and 2 months, and 6 years and 4 months respectively.

Tests of the broken rope, and also of a piece taken from the opposite rope, were made after the accident occurred, with the following results:—

(1.) The spare laps which did not come off the drum broke at 36 tons.
(2.) A piece cut off 20 feet from the fracture broke at 11 tons.
(3.) A piece corresponding to the last piece taken from the opposite rope, and instead of breaking at 11 tons it broke at 30 tons.

I made a careful examination of the shaft to try and ascertain if anything was wrong which might put an extra strain on to the rope, but failed to discover anything to lead me to think that the fault lay in the shaft.

The fracture took place 12½ fathoms from the "capping" or cage-end of the rope, and this brought the break or fractured part of the rope when standing on the "kepps" at bank half way round the drum.

The lead of the rope from the drum was a direct one.

The falling cage had evidently not touched the guides until it got 41 fathoms down, when possibly the falling rope end had got entangled with the guides or buntings which were knocked out for other 10 or 12 fathoms, where the cage was canted over and rested on one of the main buntings about 55 fathoms from the surface.

The usual daily examination and reports required by the General and Special Rules appeared to have been duly made; the latest at 3.15 o'clock p.m. on the day of the accident.

There were no broken wires in the rope, and from an external examination it seemed impossible to discover any defect. Two experts, who have had great experience with colliery ropes, were examined at the inquest and expressed the opinion that the rope, although it looked perfect, had corroded inside and the defect could not be seen by an external examination. The rope, they considered, had not been too long in use; it was made by a well-known firm and the highest price paid for it.

After a long and exhaustive inquiry held on December 6th before Mr. Coroner Graham, which I and my assistant, Mr. Walker, attended the colliery owner and the makers of the rope were represented by legal gentlemen, and the workmen by five of their agents, the jury returned the following verdict:—

"That we attach no blame to the ropemaker, and likewise the owner and officials of Burnhope Colliery have done their utmost in trying to detect any faults in the rope wherever they might have been, and it was impossible for them to detect any flaw of this sort in consequence of the corrosion being inside the rope; and that we consider the accident to have been purely accidental."

I can see no reason to disagree with this verdict.

To prevent accidents of this kind I think it would be advisable to enforce by special rule a more frequent re-capping of ropes, and, at the same time, cutting a few feet off from the end in order to remove the part of the rope from where the greatest strain takes place both on the drum and pulley, and to ascertain the internal condition of the rope.

I am not in favour of testing winding ropes by means of putting on any extra weight beyond the ordinary working load, because, in a case like this, where there was internal corrosion, it would have a tendency to further weaken that part of the rope, possibly too near the breaking point, and any subsequent friction, caused by the usual working of the rope, in passing quickly over the pulley or drum might afterwards break the rope at the injured part.

In this view I am supported by several of our most experienced mechanical engineers, whose opinion I have asked since the accident. They were unanimous in condemning the testing of ropes when in actual use.

4. *Miscellaneous Underground.*—The number of deaths which have taken place under the head of miscellaneous causes underground in the coal mines were 18, or seven more than last year and three less than the average of the preceding five years; one was from an explosion of gunpowder, three on incline and engine planes, 13 from crushes by trams or tubs, and one under the head of sundry causes.

There have been four deaths under this heading at the Cleveland Ironstone Mines during the year, the average of these mines being two for each year during the preceding five years; two were from explosions of gunpowder and two on incline and engine planes.

Number 12 on the list occurred at West Auckland Colliery on the 6th of March, about 3 o'clock p.m., causing the death of James Swinbank, a water leader.

This accident occurred in the face of a crosscut in the Brockwell Seam, dipping one in four; there were two roads lying side by side for a few yards from the face, one of them being for a water tub and the other for the coal tub. The coal tub was standing about two yards near the face than the water tub.

Deceased's duty was to ladle the water out of the place into the tub.

There was a loose rope, one end of which was attached to the full tubs in the face, and the other to the engine set to take them up the heavy gradient to the landing; the empty tubs and loose rope were let down into the place by means of a brake wheel worked by a lad, whose duty it was also to walk down and put the rope to one side of the place, so as nothing could catch it, and he was quite positive that he had done so in this case, and stated that it was the water tub he let down before the accident occurred, whereas the rope was attached to the coal tub. I imagine deceased had unloosed the rope off the water tub and pulled it down two yards and attached it to the coal tub, and in doing this had caused the rope to twist, and thus thrown the outer end on to the way. The empty set from the shaft to the landing came in, and the rope end became entangled in the tub wheels, and the coal tub in the face of the crosscut was jerked with great violence against deceased as he was in the act of passing in front of it, and injured him so severely that he afterwards died.

Number 15 on the list occurred at Murton Colliery, on the 26th of April, about 11 o'clock a.m., causing the death of Edward Hart, a trapper boy.

It appears, in this case, deceased had left his door, while the drivers were getting a meal, and took advantage of their absence to get one of the ponies and drive it from the flat to the landing.

The place was 4 feet 3 inches high, between the rail and the underside of the baulks, and it was necessary for the driver to keep their heads below the level of the top of the tub. Deceased neglected to do this and his head was caught between the tub and a baulk, causing fatal injuries.

He was never authorised to leave his door and had no right to take a pony away, without permission; by doing so, he was acting in opposition to the special rules, and so lost his lfe.

Such accidents as these should never happen; the majority of them occur through sheer carelessness and wilful breaches of rules laid down for the safety and guidance of the workmen and boys.

Number 7 on the list of accidents occurring at Cleveland Ironstone Mines occurred at the Rosedale Mines, on the 12th of October, about 1 o'clock p.m., causing the death of William Abbot, a miner.

Deceased was working in a place going to meet another, and these two places were close on holing. A hole had been drilled, charged, and stemmed, in the opposite place, by a miner named William Norwood, and to comply with Special Rule No. 67 he went round to the deceased's place and informed him and his mate that he was going to fire a shot. Both the men came out of the place and Norwood proceeded to light the shot.

Another shot exploded about the same time, and deceased, thinking it was the one Norwood had told him he was going to fire, returned to his place, and the shot blew through and so severely injured him that he died within two days of the accident occurring.

This accident was caused by deceased returning to his place too soon. There is a great tendency, which I have, time after time, stated to be highly dangerous, amongst miners, to rush back to their places directly they hear a shot explode. If they would only exercise a little more patience and wait until there could be no doubt

which shot had exploded or whether it was a "miss fire," the number of accidents, under the head of explosions of gunpowder would be very materially reduced.

Number 8 on the list occurred at Lofthouse Mines on the 24th of October, about 6.30 o'clock p.m., causing the death of George Cornall, a deputy.

This accident was caused by a shot blowing through from one place to another, but the circumstances attending it are somewhat uncommon.

A pillar was being split, for the purpose of removing it, and to do this a place was driven parallel to an old headways, the intention being to leave five yards in thickness of stone between the places. Unfortunately the new place, from the time it was commenced, began to lean, unobserved, towards the old one, and the result was that, after it had been driven a distance of about nine yards, a hole in the side next to the old headways blew through, there only being two feet of stone between the end of the hole and the side of the old place. Deceased and the shot firer had gone right opposite to where the shot blew through, thinking they were perfectly safe, but deceased was hit and never regained consciousness; the shot firer was only three feet from him and had a miraculous escape.

Deceased, along with the other officials in charge of this district of the mine, was responsible to see that the place was being driven parallel to the headways which had been previously driven, and they depended upon the eye to do this, but were evidently misled. I suggested to the manager that, in future, to prevent a re-occurrence of a fatality of this kind, places like these should be driven by marks, and he promised that my suggestion should be carried out.

5. *Accidents on the Surface.*—There have been eight people killed on the surface at the coal mines, being the same number as during last year, and three less than the average of the five preceding years; one boy climbed over the fencing on a pit heap and fell on to the railway beneath, a distance of 22 feet; one man, the engineer of the colliery, got his hand crushed while examining the machinery, and eventually died from blood poisoning; one man, a locomotive engine driver, was scalded to death by the breaking of metal steam dome, which was caught by a baulk of wood; and one locomotive fireman was killed while passing the branches; his head was struck against a projecting plank.

There has been no fatal accident on the surface at the Cleveland Ironstone Mines during the last three years.

Under this heading, for the first time, appear four fatal accidents as having occurred in this district on "Private branch railways and tramways, and in washing and coking "coal on premises adjacent to or belonging to the mines." These accidents raise the total number of people killed on the surface during the year to eight. They have not hitherto been considered as coming under the Coal Mines Act, and I am doubtful if returns will again be made by the owners unless statutory powers be obtained to enforce it during the year. The total number of persons who have been killed in the United Kingdom during the year, and placed under this heading, exceeds 30, and by raising the number to be used in the ratios has upset all calculations for comparisons with previous years.

Number 43 on the list occurred at Ushaw Moor Colliery on the 7th of October, about 11 o'clock a.m., causing the death of Thomas Bell, an engineman.

This accident was of an unusual character, and therefore I do not think to describe it I can do better than give in full the evidence taken at the inquest held before Mr. Coroner Graham on the 9th of October.

It was as follows :—

Henry Graham said: "I am a locomotive fireman. The regular driver of the "locomotive on which the accident occurred is John Herron. Deceased has been a "winding engineman for several years and has on previous occasions acted as relief "locomotive driver when Herron has been absent. He thoroughly understood the "work and engine. On the morning in question he relieved Herron, and took charge "of the locomotive at 9 o'clock. He had been working at the winding from 10 p.m. "to 6 a.m. on the morning of the accident, but before coming on to the locomotive he "went home and had a little rest and his breakfast. I acted as fireman with him. "About the time of the accident we went to the fan depôt and took a truck out at the

" back end of the engine, and then proceeded to the new coke yard at the east end of " the colliery, and joined up to some full waggons, of which four were coupled on at " the front end of the engine. The empty waggon was then run under the screens, " the gradient being that way. I then gave deceased the signal to start, and he did so. " I ran down to see that the switches leading to the screens had been altered, when " deceased shouted 'Right,' which I took to mean that they were set right for the way " we were going, and that was outside of the screens altogether. The first switches " were self-acting and we passed through them safely; we then came to those " connecting the way to the screens, which were worked by a handle. The way the " engine was going gave deceased a clear view of the way and switches, but unfor- " tunately they had not been altered since the truck was run into the screens, and the " engine, therefore, took that way. I did not notice that we were going the wrong " way, but some one shouted. I did not understand what for, but thought we had " lost some waggons off, and shouted to deceased to stop; he heard and understood " me, and applied the brake. Instinctively I must have jumped off the engine. " I do not know what happened afterwards. The pressure gauge registered 120 lbs. " just before the accident, and that is the pressure at which the steam blows off."

John Mould said: "I am a small runner, and when the accident occurred I was " standing on the coke ovens and had a good view of the road the engine was taking. " I saw the engine start from the new coke yard, and it went at a medium rate. " I saw it afterwards take the wrong way at the switches and make direct for the " screens. I instantly shouted to attract the attention of the firemen, who had just " jumped on to the engine. I then saw deceased apply the brake, and the trucks " join each other, and the engine was immediately forced against the gangway, under " which it partly ran and broke the steam dome off, and there was a great rush of " steam and hot water, and on that account I saw nothing more."

Robert Curry said: "I am engineer at Ushaw Moor Colliery and had charge of this " locomotive. I have had experience with others of a similar type. Some have had " cast iron domes, but the majority have had them made of wrought iron. This was " a new engine when it came here, in 1891, direct from the makers, Messrs. Black, " Hawthorn, and Company, of Gateshead-on-Tyne. The regulating lever, when I first " saw it after the accident, was bent as it is now, but I cannot say whether the steam " was on or off at the time of the accident. I examined the engine on Friday night, " and made a report of such inspection. It was then all right. I knew the dome was " of cast iron and took it for granted that it was quite safe. I consider it is a good " casting and free from honey-combing. It is scant $\frac{3}{4}$ of an inch of metal on one side " and $\frac{13}{16}$ of an inch on the other."

Jacob Swan said: "I am a boilermaker employed at Messrs. Black, Hawthorn, and " Company's works. They build many locomotives of this type. Sometimes they are " fitted with cast iron and sometimes wrought iron domes. I should say the number " of each will be about equal. It is quite a matter of fancy and specification which is " put in. A wrought iron dome would be safer than a cast iron one in the case of its " receiving a blow, but it is possible that if a wrought iron one had such a blow, as " this one of cast iron had, it would have torn away at the rivet holes, and the result " would have been the same. All boilers and domes are tested before leaving the " works by hydraulic pressure to 220lbs. per square inch."

After a very careful inquiry the jury returned a verdict of "Accidental death," with a recommendation "that, in future, a falling lever be attached to the switches, so that they could not remain open for the screens."

This recommendation was carried out, and I am hopeful that it will prevent an accident of this kind in the future.

The cast iron dome was altogether new to me; all the locomotives I have seen up to this time having had them made of wrought iron, and they are, in my opinion, much safer than those made of cast iron. Had this locomotive been fitted with one of wrought iron I am inclined to believe that this lamentable accident would not have occurred.

The following table is of interest, as showing the hour of the shift, that is, during what hour, after the commencement of their shifts, the fatal accident happened to persons employed in and about the Coal and Ironstone Mines, under the Coal Mines Regulation Act. In this table are included (for the first time) those accidents which

have taken place, during the year 1893, on private branch railways and tramways, and in washing and coking coal on premises adjacent to or belonging to the mines.

Hour of Shift.	1890.	1891.	1892.	1893.	Total for Four Years.
Underground.					
First - - -	1	8	4	4	17
Second - -	8	7	3	6	24
Third - - -	11	7	7	14	39
Fourth - -	8	13	10	8	39
Fifth - - -	10	6	4	8	28
Sixth - - -	7	15	8	13	43
Seventh - -	6	6	7	6	25
Eighth - -	6	4	3	5	18
Ninth - - -	3	4	1	2	10
Tenth - - -	—	4	2	2	8
Eleventh - -	1	—	—	—	1
Twelfth - -	—	—	—	—	—
More than 12 hours -	2	—	—	—	2
Total underground -	63	74	49	68	254
Above-ground.					
First - - -	1	3	—	—	4
Second - -	—	—	—	—	—
Third - - -	—	1	2	2	5
Fourth - -	1	—	—	1	2
Fifth - - -	—	—	—	2	2
Sixth - - -	1	—	—	2	3
Seventh - -	—	—	—	—	—
Eighth - -	—	—	—	1	1
Ninth - - -	—	1	2	—	3
Tenth - - -	—	2	—	—	2
Eleventh - -	—	—	—	—	—
Twelfth - -	—	—	—	—	—
More than 12 hours -	1	—	—	—	1
Total above-ground -	4	7	4	8	23
Total number of fatal accidents	67	81	53	76	277

METALLIFEROUS MINES.

There have been no fatal accidents at the metalliferous mines during the year, and only four cases of serious personal injury have been reported. One miner had a finger blown off, and serious injury to his eye caused by inserting a pricker into a hole that had missed fire ; it struck the detonator, which exploded a charge of dynamite. Another miner was injured by the explosion of a powder shot; he lighted the squib by mistake instead of the match and the charge exploded before he could get clear out of the way of it. One miner was injured by a kibble falling down a shaft in which he was working; and an ore dresser received severe injuries to his head by the upsetting of a waggon on the surface.

The Durham mines employed 733 persons underground, and 390 above-ground, or a total of 1,123 persons.

The Westmorland mines employed 149 persons underground, and 132 above-ground, or a total of 281 persons.

The North Riding of Yorkshire mines employed 324 persons underground and 161 above-ground, or a total of 485 persons, making a total of 1,206 and 683 persons respectively, and 1,889 in the aggregate.

There were also 42 people employed about the metalliferous open works ; and 705 about the salt or brine pits and works making, a grand total of 2,636 people employed about all these works.

The aggregate quantity of mineral worked at the mines in the three above-named counties during the year under notice was 106,523 tons; that got from open works amounted to 6,925 tons ; and the salt made from brine in Durham and North Yorkshire was 289,198 tons; this is an increase of 58,138 tons of salt over the production in 1892

but is accounted for by the loss of time caused by the want of coal during the strike in the early part of 1892. Full details of persons employed and mineral produced under this head will be found in Schedule B. herewith appended.

During the year under notice the collieries and mines of the district have worked fairly well, particularly the last six months. This might have been anticipated, considering the general stoppage of the mines in the Midland Counties; the output has increased rather in excess of that of 1891. It is not a fair comparison, either of the working or accidents of 1893 with those of 1892, because of a strike extending over three months during the last-named year.

The total numbers of days the coal and ironstone mines have worked, as returned to me under Schedule III. of the Act, during the last two years are as follows:—

Coal mines during 1892	45,790		
" " 1893	54,271,	being an increase of	8,481 days.
Ironstone mines during 1892	4,542		
" " 1893	5,925	" "	1,383 days.
Making a total increase of pits working days during the year			9,864

But the loss of work during the year 1892 as compared with year 1891 was 14,114 days, showing that all the pits are not yet in full work.

The following table will be found interesting as showing the number of persons employed in and about the mines, the quantity of mineral raised, number of lives lost, persons employed and tons of mineral produced per life lost, and the production for each person employed during the last 14 years in the Durham district:—

Part of District.	Year.	Persons employed in and about the Mines.	Total Tons of Mineral produced.	Lives lost.	Persons employed per Life lost.	Tons of Mineral wrought per Life lost.	Tons of Mineral raised per Person employed.	Remarks.
At the Coal Mines	1880	53,240	21,340,737	242	220	88,185	400	
	1881	54,825	21,818,054	85	645	256,683	398	
	1882	55,980	22,170,016	190	294	116,684	396	
	1883	57,077	22,512,617	65	878	346,348	394	
	1884	56,575	21,190,581	74	764	286,359	374	
	1885	55,771	20,623,492	78	715	264,403	370	
	1886	54,985	20,346,032	83	662	245,133	370	
	1887	55,485	21,227,512	81	685	262,068	382	
	1888	56,575	21,734,358	75	755	289,791	384	
	1889	58,633	22,249,264	83	707	268,063	379	
	1890	62,619	22,512,695	58	1,080	388,149	359	
	1891	66,192	21,764,501	70	946	310,921	329	
	1892	65,289	17,144,206	45	1,451	380,982	262	3 months' strike.
	1893	71,167	22,104,308	71	1,002	311,328	310	* Persons employed and accidents under C. are included.
At the Cleveland Ironstone Mines	1880	7,972	6,447,053	18	443	358,170	808	
	1881	8,122	6,481,500	24	338	270,062	798	
	1882	8,099	6,331,839	21	381	301,516	790	
	1883	8,243	6,760,438	30	275	225,348	820	
	1884	7,050	6,053,552	12	587	504,463	858	
	1885	6,713	5,932,244	10	671	593,224	883	
	1886	5,918	5,370,779	17	348	315,928	907	
	1887	5,738	4,980,421	12	478	415,035	868	
	1888	5,846	5,396,567	14	418	385,469	923	
	1889	6,542	5,657,118	5	1,308	1,131,424	864	
	1890	6,579	5,619,328	9	731	624,258	854	
	1891	6,080	5,128,303	13	468	394,485	843	
	1892	5,409	3,411,400	9	601	379,044	630	Affected by the Durham strike.
	1893	5,266	4,625,520	9	585	513,947	878	* Persons employed and accidents under C. are included.

* The persons employed on private branch railways and tramways, and in washing and coking coal on premises adjacent to or belonging to the mines under the head C. are included for the first time this year.

The two following tables are new and will be found of interest as showing the annual mortality in the Durham district when compared with the United Kingdom.

TABLES SHOWING ANNUAL MORTALITY, &c.

TABLE showing the ANNUAL MORTALITY caused by ACCIDENTS at the MINES in the UNITED KINGDOM OF GREAT BRITAIN AND IRELAND, under the Coal Mines Regulation Acts, 1872 and 1887, to the PERSONS employed ABOVE and BELOW GROUND, during the past 21 YEARS, 1873 to 1893 inclusive, together with the Death-rate per 1,000 Persons employed; the Gross Tons of Mineral wrought; the Number of Tons raised per Life lost; the Out-put per Person employed; and the Number of Mines.

COMPILED FROM OFFICIAL RETURNS.

Year.	Number of Persons employed.			Number of Deaths, and Death-rate per 1,000 Persons employed Below Ground and Above Ground.														Gross Tons of Mineral Wrought.			Number of Mines.
	Below Ground.	Above Ground.	Total.	From Explosions of Firedamp.		From Falls in the Mine.		In Shafts.		Miscellaneous Accidents Below Ground.		Total Below Ground.		Total Above Ground.		Gross Total Below Ground and Above Ground.		Gross Statute Tons.	Tons of Mineral Wrought. Per Life Lost.	Tons of Mineral Wrought. Per Person employed.	
				Total Deaths.	Deaths per 1,000.	Total Deaths.	Deaths per 1,000.	Total Deaths.	Deaths per 1,000.	Total Deaths.	Deaths per 1,000.	Total Deaths.	Deaths per 1,000.	Total Deaths.	Deaths per 1,000.	Total Deaths.	Deaths per 1,000.		Above and Below Ground.	Above and Below Ground.	
1873	407,808	106,341	514,149	100	·245	491	1·204	171	·419	221	·542	983	2·410	86	·808	1,069	2·079	143,041,246	133,677	278	3,938
1874	428,611	110,218	538,829	166	·387	413	·964	154	·359	214	·499	947	2·209	109	·988	1,056	1·959	140,713,832	133,251	261	4,332
1875	427,017	108,828	535,845	288	·674	458	1·072	172	·402	227	·531	1,145	2·679	99	·918	1,244	2·321	147,700,313	118,730	275	4,501
1876	409,229	105,303	514,532	95	·232	449	1·097	129	·315	149	·364	822	2·008	111	1·053	933	1·813	148,989,385	159,688	290	4,385
1877	395,025	99,366	494,391	345	·873	448	1·135	129	·326	187	·473	1,109	2·807	99	·990	1,208	2·443	148,846,260	123,217	301	4,231
1878	382,979	92,350	475,329	586	1·531	469	1·222	111	·289	161	·420	1,327	3·462	86	·931	1,413	2·972	145,798,138	103,183	307	3,968
1879	385,179	91,631	476,810	184	·477	426	1·105	120	·311	172	·446	902	2·339	71	·774	973	2·040	145,366,369	149,100	305	3,956
1880	391,381	93,552	484,933	499	1·275	462	1·180	91	·232	178	·455	1,230	3·142	88	·940	1,318	2·718	161,466,793	122,509	333	3,904
1881	399,387	96,090	495,477	116	·290	450	1·127	110	·275	190	·476	866	2·168	88	·811	954	1·925	168,959,931	177,106	341	3,847
1882	406,192	97,795	503,987	250	·615	468	1·152	116	·286	208	·512	1,042	2·565	84	·958	1,126	2·234	171,334,032	152,161	339	3,814
Totals, &c. for 10 years	4,032,808	1,001,474	5,034,282	2,629	·652	4,534	1·124	1,303	·323	1,907	·473	10,373	2·572	921	·919	11,294	2·243	1,522,216,299	133,099	302	4,088
1883	416,696	98,237	514,933	134	·322	469	1·125	97	·233	246	·590	946	2·270	108	1·099	1,054	2·046	178,763,390	169,605	347	3,707
1884	422,233	98,143	520,376	65	·154	482	1·142	88	·208	213	·504	848	2·008	94	·956	942	1·810	174,872,759	185,639	336	3,554
1885	424,191	96,441	520,632	341	·803	439	1·034	76	·179	219	·518	1,075	2·534	75	·982	1,150	2·207	173,223,960	150,629	332	3,488
1886	423,862	96,108	519,970	129	·304	461	1·087	86	·203	188	·444	864	2·038	89	·821	953	1·833	170,006,959	178,391	327	3,391
1887	428,540	97,737	526,277	149	·347	470	1·097	84	·196	213	·497	916	2·137	79	·808	995	1·890	173,049,795	173,919	328	3,382
1888	438,902	96,043	534,945	49	·111	471	1·073	75	·171	209	·476	804	1·831	84	·874	888	1·660	182,660,163	205,698	341	3,354
1889	463,600	100,135	563,735	138	·297	465	1·003	74	·157	292	·629	969	2·086	95	·848	1,064	1·887	189,633,656	178,227	336	3,389
1890	506,812	106,421	613,233	290	·572	434	·856	88	·174	245	·483	1,057	2·085	103	·967	1,160	1·891	194,605,887	167,763	317	3,409
1891	536,091	112,359	648,450	51	·095	476	·888	119	·222	236	·440	882	1·645	97	·862	979	1·510	197,693,592	201,934	304	3,430
1892	549,312	114,988	664,300	123	·225	435	·791	91	·165	255	·464	904	1·645	78	·678	982	1·478	191,954,908	195,473	289	3,403
Totals, &c. for 10years	4,610,239	1,016,612	5,626,851	1,469	·318	4,602	·998	878	·190	2,316	·503	9,265	2·009	902	·886	10,167	1·985	1,826,465,069	179,646	324	3,451
*1893	549,738	132,435	682,173	160	·287	412	·749	103	·187	265	·486	940	1·709	120	·900	1,060	1·552	175,236,857	168,148	257	3,383

* The persons employed on private branch railways and tramways, and in washing and coking coal on premises adjacent to or belonging to the mines (but which do not come under the Act) are included in these figures this year for the first time.

TABLE showing the ANNUAL MORTALITY caused by ACCIDENTS at the MINES in DURHAM INSPECTION DISTRICT (No. 4), comprising the Southern Portion of the County of Durham, the County of Westmorland, and the North Riding (Cleveland) of the County of York, under the Coal Mines Regulation Acts, 1872 and 1887, to the PERSONS employed ABOVE and BELOW GROUND, during the past 21 YEARS, 1873 to 1893 inclusive, together with the Death rate per 1,000 Persons employed; the Gross Tons of Mineral wrought; the Number of Tons raised per Life lost; the Out-put per Person employed; and the Number of Mines.

COMPILED FROM OFFICIAL RETURNS.

Year.	Number of Persons employed.			Number of Deaths, and Death-rate per 1,000 Persons employed Below Ground and Above Ground.														Gross Tons of Mineral Wrought.			Number of Mines.
	Below Ground.	Above Ground.	Total.	From Explosions of Firedamp.		From Falls in the Mine.		In Shafts.		Miscellaneous Accidents Below Ground.		Total Below Ground.		Total Above Ground.		Gross Total Below Ground and Above Ground.		Gross Statute Tons.	Tons of Mineral Wrought. Above and Below Ground.		
				Total Deaths.	Deaths per 1,000.	Total Deaths.	Deaths per 1,000.	Total Deaths.	Deaths per 1,000.	Total Deaths.	Deaths per 1,000.	Total Deaths.	Deaths per 1,000.	Total Deaths.	Deaths per 1,000.	Total Deaths.	Deaths per 1,000.		Per Life Lost.	Per Person Employed.	
1873	49,225	13,482	62,707	1	·020	43	·874	10	·203	36	·731	90	1·828	11	·816	101	1·610	23,336,621	231,054	372	215
1874	52,543	12,998	65,541	2	·038	31	·590	14	·266	32	·609	79	1·503	17	1·309	96	1·465	23,844,628	248,381	363	218
1875	54,528	13,855	68,383	1	·019	48	·880	13	·237	29	·532	91	1·668	14	1·010	105	1·535	25,982,039	247,543	379	257
1876	54,175	14,056	68,231	6	·111	49	·905	5	·092	18	·332	78	1·440	16	1·138	94	1·377	26,493,819	281,849	388	258
1877	51,999	13,015	65,014	2	·038	47	·904	12	·231	33	·635	94	1·808	22	1·690	116	1·784	26,147,523	225,409	402	256
1878	48,449	11,248	59,697	4	·083	44	·908	7	·144	34	·702	89	1·837	11	·978	100	1·675	24,168,785	241,688	404	263
1879	45,779	10,955	56,734	—	—	38	·830	7	·153	22	·480	67	1·463	4	·365	71	1·075	22,049,725	310,560	388	261
1880	49,329	11,883	61,212	164	3·323	43	·872	8	·162	33	·670	248	5·027	12	1·014	260	4·248	27,787,790	106,876	454	267
1881	50,433	12,514	62,947	—	—	47	·932	13	·258	34	·674	94	1·864	16	1·279	110	1·748	28,299,554	257,268	449	258
1882	51,075	12,914	63,989	127	2·486	45	·881	4	·079	26	·509	202	3·955	9	·696	211	3·298	28,501,855	135,080	445	257
Totals, &c. for 10 years	507,535	126,920	634,455	307	·606	435	·857	93	·183	297	·586	1,132	2·232	132	1·039	1,264	1·992	256,612,389	203,016	404	251
1883	52,091	13,229	65,320	—	—	47	·903	3	·057	37	·710	87	1·670	8	·604	95	1·454	29,273,055	308,137	448	258
1884	50,592	13,033	63,625	—	—	41	·811	6	·118	26	·514	73	1·443	13	·997	86	1·351	27,244,133	316,792	431	223
1885	50,038	12,446	62,484	—	—	39	·779	7	·140	36	·719	82	1·638	6	·482	88	1·409	26,555,736	301,770	425	230
1886	48,480	12,423	60,903	28	·577	45	·928	1	·021	18	·371	92	1·897	8	·644	100	1·642	25,716,811	257,168	424	226
1887	48,758	12,465	61,223	—	—	42	·861	4	·082	39	·800	85	1·743	8	·642	93	1·519	26,207,933	281,805	428	222
1888	50,137	12,285	62,422	—	—	47	·937	2	·040	32	·638	81	1·615	8	·651	89	1·425	27,130,925	304,842	434	238
1889	52,354	12,851	65,205	—	—	44	·840	5	·095	27	·516	76	1·451	12	·934	88	1·350	27,906,382	317,118	428	223
1890	55,672	13,526	69,198	—	—	38	·683	3	·053	22	·395	63	1·131	4	·295	67	·968	28,132,018	419,880	406	223
1891	57,994	14,278	72,272	—	—	46	·793	7	·120	23	·397	76	1·310	7	·490	83	1·148	26,892,804	324,010	372	225
1892	56,818	13,880	70,698	—	—	32	·562	4	·070	14	·248	50	·880	4	·288	54	·763	20,555,606	380,659	291	228
Totals, &c. for 10 years	522,934	130,416	653,350	28	·054	421	·805	42	·080	274	·524	765	1·463	78	·598	843	1·290	265,615,403	315,083	406	230
*1893	57,671	18,762	76,433	2	·034	39	·676	9	·157	22	·381	72	1·248	8	·426	80	1·046	26,729,828	334,120	349	229

* The persons employed on private branch railways and tramways, and in washing and coking coal on premises adjacent to or belonging to the mines (but which do not come under the Act) are included in these figures this year for the first time.

The following table shows the total imports of iron ore (chiefly Spanish or Hematite) into the north-east ports of England, and the production of ironstone in the Cleveland Ironstone Mines (both of which are smelted within the area of the Cleveland district) during the past five years. It also shows the quantity of pig-iron made from the Cleveland and Hematite ores respectively during the same period:—

Ports.	YEARS.				
	1889.	1890.	1891.	1892.	1893.
	Tons.	Tons.	Tons.	Tons.	Tons.
Hartlepool	181,059	147,383	125,769	110,844	90,294
Middlesbro'	855,527	947,440	778,234	886,352	1,269,034
Newcastle	373,753	513,493	388,460	241,804	268,389
Shields	24,559	80,024	57,511	85,199	88,633
Stockton	124,503	129,432	148,086	123,243	250,682
Sunderland	96,568	47,271	71,132	74,425	94,005
Total imports of iron ore	1,655,969	1,865,043	1,569,192	1,521,867	2,061,037
Production of Cleveland ironstone mines	5,657,118	5,617,573	5,128,303	3,411,400	4,625,520
Make of Cleveland Pig-Iron	1,528,646	1,539,250	1,493,146	957,047	1,388,043
" Hematite "	1,242,535	1,306,839	1,129,586	980,422	1,336,141
Total make in district	2,771,181	2,846,089	2,622,732	1,937,469	2,724,184

From the returns received under Section 66 of the Act, it appears that 29 workmen or boys have been proceeded against by the owners for breaches of the Act or Special Rules. Three were fined by the magistrates for the dangerous practice of riding on the engine sets, and four for riding on sets of tubs drawn by horses. Six were fined for being in a part of a mine where not authorised to go by officials. Four were fined for carelessly leaving powder loose in the mine. One was fined for improper treatment of a safety lamp by striking the manager with it, and two for improperly opening safety lamps with a nail. Three were fined for ill-treating ponies; and one, for cruelty to his pony, was sent to gaol for a month without the option of paying a fine. One was fined for wilfully throwing a pick down a shaft while men were ascending. One was fined for passing through a fence into a place where there was danger. One was fined for endangering the lives of the workmen by propping open a ventilating door; and one deputy was fined for neglecting to fence off a part of a mine where he had discovered danger. Proceedings were also taken against a checkweighman, whom the owners charged with unduly interfering with the workmen. The charge was not pressed against him on his giving a guarantee for future good conduct.

The total amount of fines inflicted was 12*l.* 19*s.* 6*d.*, and the court and other costs amounted to 14*l.* 14*s.* 6*d.*, or a total of 27*l.* 14*s.*

I have received nine complaints, made by the workmen on their inspection, under the 38th General Rule, this year; only one of them was anonymous.

I have also received seven copies of workmen's reports, made on their inspections, where there were some defects or apprehended danger; each case was attended to without delay, and the defects, if any, were immediately remedied, there being nothing arising out of any of them necessitating legal proceedings.

EXEMPTIONS.

The following four exemptions have been granted during the year, under notice, by the Secretary of State, under the Coal Mines Regulation Act, 1887 :—

1. An exemption, dated 16th February 1893, X. 40,624, was granted to the North Beechburn Coal Company Limited, under section 18 (ii.) (*b*), to enable them to Seam, away the pillars, cutting off the second shaft or outlet in the Brockwell work at their Tees Hetton Colliery, so long as not more than 20 persons are employed underground at one time.

2. An exemption, dated 20th March 1893, X. 41,022, was granted to the Ivesley Coal Company, under section 18 (ii.) (*b.*), to enable them to work away the pillars, cutting off the second shaft or outlet, in the Brockwell Seam, at their Dicken House Drift, Ivesley Colliery, so long as not more than 20 persons are employed underground at one time.

3. An exemption, dated 18th May 1893, X. 42,007, was granted to Mr. Thomas Wales, under section 18 (iii.) (*a.*), to work with one shaft until the 30th day of June next, to enable him to construct a second outlet at his Abbots Close Colliery, provided not more than 20 persons are employed underground at one time.

4. An exemption, dated 16th October 1893, X. 44,355, was granted until the 31st October 1894, to the Framwellgate Coal Company, Limited, under section 18, to enable them to employ 20 persons underground in the Hutton Seam during the making of a second outlet, the original outlet having become unavailable in consequence of a heavy fall of roof at their Framwellgate and Dryburn Collieries.

The following seven exemptions have been granted, during the year, by Her Majesty's Inspector of Mines for the district, under the Coal Mines Regulation Act, 1887 :—

1. An exemption, dated the 27th February 1893, was granted to the North Beechburn Coal Company, Limited, for one year, to the use of guides, signals, and a cover overhead, under section 49, General Rules 25 and 27, during the sinking of the Randolph shaft to the Brockwell Seam, at their Tees Hetton Colliery, Evenwood.

2. An exemption, dated the 9th March 1893, was granted to the South Moor Collieries Company, Limited, for one year, to the use of guides, signals, and a cover overhead, also under General 25 and 27, during sinking operations of a ventilating shaft, near to the Charley Pit, at their South Moor Colliery.

3. An exemption, dated 28th April 1893, was granted to Messrs. Cochrane & Co., for one year, to the use of guides, signals, and a cover overhead, also under General Rules 25 and 27, during the sinking of a shaft at their New Brancepeth Colliery.

4. An exemption, dated the 17th June 1893, was granted to Messrs. Lishman & Co., for one year, to the use of guides, signals, and a cover overhead, also under General Rules 25 and 27, during the sinking of a pit from the Hutton to the Busty Seam at their Durham Main Colliery.

5. An extended exemption, dated the 15th August 1893, was granted to the Consett Iron Company, Limited, for one year, to the use of guides, signals, and a cover overhead, also under General Rules 25 and 27, during the completion of sinking operations of Kaysburn Shaft at their Langley Park Colliery.

6. An exemption, dated the 16th October 1893, was granted to the Hetton Coal Company, Limited, for one year, to the use of guides, signals, and a cover overhead, also under General Rules 25 and 27, during the sinking of a staple or small pit for water at their Hetton Colliery.

7. An exemption, dated the 3rd November 1893, was granted to the North Beechburn Coal Company, Limited, until the 30th June 1894, to the use of guides, signals, and a cover overhead, also under General Rules 25 and 27, during the sinking of a pit and a staple from the 5/4 to the Brockwell Seam at their Gordon House Colliery.

All the above-mentioned exemptions refer to mines situated in the county of Durham.

Abandoned Mines.

The following is a list of the plans and sections of abandoned mines or seams which have been forwarded to the Home Office during the year under notice, to be preserved under the care of the Secretary of State, in accordance with section 38 of the Coal Mines Regulation Act, 1887, and with section 14 of the Metalliferous Mines Act, 1872, after having been examined and compared with the original plan by the inspector of the district and certified to be correct :—

1. B. 13,509. Under the Coal Mines Regulation Act. Plan and section of the Brockwell Seam at Woodland, Cust Barn, and Foul Syke Collieries, situated in the parish of Cockfield, in the county of Durham, belonging to the Woodland Collieries Company, Limited, Darlington, which was abandoned in consequence of all the mineral being exhausted.

2. B. 14,807. Under the Coal Mines Regulation Act. Plan and section of the Crags Hall Ironstone Mine, situated in the parish of Brotton-in-Cleveland, and in the North Riding of the county of York, belonging to Messrs. Pease and Partners, Limited, Darlington, which was abandoned in April 1893, on the expiration of the lease, the mine being unprofitable to work.

3. B. 15,405. Under the Coal Mines Regulation Act. Plan and section of the Brockwell Seam at Morley Colliery, situated in the parish of Evenwood, in the county of Durham, belonging to Mr. Andrew Mein, of Bishop Auckland, which was abandoned in November 1893 in consequence of all the mineral having been worked out or exhausted.

Board for Examinations.—Colliery Managers.

The Board for the appointment of examiners for granting certificates of competency to colliery managers, and under managers, consists, as formerly, of the following gentlemen, viz. :—

Colliery owners	David Dale, Esq., West Lodge, Darlington. Lindsay Wood, Esq., The Hermitage, Chester-le-Street. J. B. Eminson, Esq., Dene House, Seaham Harbour.
Mining Engineers	A. L. Stevenson, Esq., Holywell Hall, Durham. John Daglish Esq., Rothley, Northumberland. Robt. Robinson, Esq., Howlish Hall, Darlington.
Working miners	Mr. George Parker, Page Bank Colliery, Willington. Mr. Henry Todd, 6, Newcastle Street, Ouston. Mr. John Norman, 1, Reid Terrace, Guisbro'.
Her Majesty's Inspector of Mines	Thomas Bell, Esq., Durham.
Secretary	G. W. Bartlett, Esq., Red Hall, Darlington.

The ordinary board meeting was held, as before, in the Coal Trade Hall, Newcastle-on-Tyne, on the 20th May last, to appoint a time and place to hold the examination, to consider and define qualifications of candidates, and transact other formal business.

The examiners appointed were Mr. A. L. Steavenson and Mr. Thomas Lishman, mining engineers, and Mr. John Forman.

The examination was held in the large hall of the Mechanics' Institute, at Darlington, on the 26th and 27th days of July, when 9 candidates presented themselves for first class, and 47 for second class certificates.

The Board met again in Newcastle on the 18th of November to receive the report of the examiners, which was considered satisfactory.

The following table gives a summary of the gross number of candidates who have presented themselves for examination during the continuance of the 1872 Coal Mines Regulation Act, showing the number who satisfied the examiners and received certificates of the first class; and also the number of candidates who have presented themselves each year since the commencement of the 1887 Act, and have received certificates distinguishing those of the first from the second class.

Date of Examination.	First Class.		Second Class.	
	Attended.	Passed.	Attended.	Passed.
Under the 1872 Act. 15 years - - -	371	236	—	—
1888. July 30th and 31st (under the 1887 Act) -	10	5	82	59
1889. July 22nd and 23rd (ditto) -	8	5	75	47
1890. July 22nd and 23rd (ditto) -	9	6	118	64
1891. July 21st and 22nd (ditto) -	12	7	56	34
1892. July 26th and 27th (ditto) -	13	5	43	12
1893. July 26th and 27th (ditto) -	9	5	47	20

The regulations of the Board for examinations under the Coal Mines Regulation Act, 1887, are as follows:—

BOARDS FOR EXAMINATIONS.

COAL MINES REGULATION ACT, 1887.

"SCHEDULE II."

TABLE OF MAXIMUM FEES TO BE PAID IN RESPECT OF CERTIFICATES.

FIRST CLASS CERTIFICATES.

By an applicant for examination - - Two pounds.
For copy of certificate - - - Five shillings.

SECOND CLASS CERTIFICATE.

By an applicant for examination - - One pound.
For copy of certificate - - - Two shillings and sixpence.

Any person desirous of being examined must make an application to the Secretary of State, in the form hereunder set forth, enclosing therein a Post Office Order, or postal note, for the fee of 2*l*. or 1*l*., as the case may be, in favour of Carey J. Knyvett, Esquire, C.B., Home Office, Whitehall, London, made payable at the General Post Office. The applicant will then receive from the Home Office an authority to present himself for examination before the examiners appointed for the district.

Form of Application for Examination.

Date ______________________

Full postal address ______________________

Sir,

I beg to inform you that I am desirous of presenting myself to be examined by the Examiners for the district of   for a   class Certificate of Competency as   of a mine, and I enclose a Post Office Order for the sum of £   .

I am, Sir,
Your obedient Servant,
____

To the Right Hon. the Secretary of State
for the Home Department.

To be accompanied by statements, on paper of foolscap :—

1. Name and address in full of applicant for (first or second class certificate). 1.

2. Name of the district in which the applicant wishes to be examined. 2.

Certificates of Service.

Any person who satisfies the Secretary of State either that before the passing of the Act (16th September 1887) he was exercising, and has since that date exercised, or that he has at any time within five years before the passing of the Act, for a period of not less than 12 months, exercised functions substantially corresponding to those of an under-manager in a mine, is entitled to a certificate of service, which shall have the same effect, for the purposes of the Act, as a second-class certificate of competency granted under the Act (section 80).

The fee to be paid by an applicant for a certificate of service is 5*s*.

Forms of application, containing full directions and particulars, will be supplied to applicants by the Home Office on request being made by a letter as follows :—

Sir,

I beg to apply for a form of application for a Certificate of Service as under-manager of a mine.

I am, Sir,
Your obedient servant,
____

To the Right Hon. the Secretary of State
for the Home Department.

Order fixing Fees for Copies of Certificates.

Coal Mines Regulation Act, 1887.

I, the Right Hon. Henry Matthews, one of Her Majesty's Principal Secretaries of State, in pursuance of the power vested in me by section 30 and Schedule II. of the Coal Mines Regulation Act, 1887 (50 & 51 Victoria, chapter 58.) do hereby direct that the sum of five shillings shall be the fee to be paid in respect of a certified copy of a first class certificate of competency or of a certificate of service as manager of a mine under the said Act.

Also that the sum of two shillings and sixpence shall be the fee to be paid in respect of the issue of a certified copy of a second class certificate, whether of competency or of service as under-manager of a mine under the said Act.

Given under my hand, at Whitehall, this 19th day of November 1888.

HENRY MATTHEWS,
One of Her Majesty's Principal
Secretaries of State.

It will be necessary for each candidate before his examination can be proceeded with to produce to the Examiners—

1. The authorisation from the Secretary of State to appear for examination.
2. The prescribed evidence as to character, consisting of—
   a. A statement of the situation he has filled during the past five years, to which a declaration must be appended that all the allegations are true, such declaration being signed by him in the presence of one witness.
   b. Testimonials from two persons (whose addresses must be given) as to his sobriety, experience, ability, and general good conduct.
3. Satisfactory evidence that he has not had less than five years' practical experience in a mine.

Candidates appearing a second time must produce fresh evidence of their sobriety, experience, and general good conduct.

Candidates must give notice to the Secretary of the Board of their intention to present themselves for examination, and stating for which class of certificate they wish to be examined.

STATEMENT SHOWING THE AGE AND EXPERIENCE REQUIRED AND SUBJECTS FOR EXAMINATIONS OF CANDIDATES FOR FIRST AND SECOND CLASS CERTIFICATES OF COMPETENCY, IN THIS DISTRICT, FOR THE YEAR 1893.

No. 4. DURHAM DISTRICT.

The candidate must be 21 years of age or upwards.

FOR FIRST CLASS CERTIFICATES:—

Actual practical experience for at least five years as under viewer, assistant viewer, fore overman, back overman, master wasteman, or master shifter; but at least two years' actual experience in any of these capacities will be deemed sufficient in the case of a candidate who during such two years has held a second class certificate.

Two years' or three years' apprenticeship under Indenture to a mining engineer, with evidence that such period afforded substantially practical experience in a mine, shall be regarded as a substitute for an equivalent period of such employment.

FOR SECOND CLASS CERTIFICATES:—

Practical experience in a mine for at least five years, which shall include, in addition to the foregoing employments, deputy overman, or practical working miner.

FOR FIRST CLASS CERTIFICATES:—

1. Writing and arithmetic.
2. Nature and properties of gases, such as giving a description of the characteristics of those met with in mines, how their presence can be ascertained, and what precautions should be taken to prevent their accumulation, or removal, if they do accumulate. How the quantity of air in any air-way can be ascertained.
3. General engineering principles, including surveying and strength of materials, properties of steam and water.
4. Practical mining, including principles of ventilation, sinking, working, timbering, bratticing, boring on approaching old workings, also machinery and boilers in general use at collieries.
5. The "General Rules" of the "Coal Mines Regulation Act, 1887," the "Special Rules" of this Board's mining district, the "Explosives Act," the "Boiler Explosions Acts, 1882 and 1890," and some knowledge of ambulance work.
6. Geology, especially in the mining district of this Board.

FOR SECOND CLASS CERTIFICATES :—

The same subjects as above so far as they are necessary for practical working miners.

Attached to this report will be found the usual Schedules A. to H., showing respectively the output of mineral and number of persons employed at Mines under the Coal Mines Act, with a comparison for the previous year; the output of mineral and number of persons employed at Mines under the Metalliferous Mines Act, with a comparison for the previous year; the number of fatal accidents and lives lost at both Coal and Ironstone Mines, with a comparison for the previous five years. Detailed tables are given of the deaths which have taken place at the Mines under both Acts, together with a list of deaths that have taken place on private branch railways and tramways, and in washing and coking coal on premises adjacent to or belonging to the mines. These do not come under the Mines Inspection Acts, but they are included in the Summaries this year for the first time. There will also be found a list of deaths that have occurred in or about the mines of persons who were employed, and some whose deaths were found on investigation not to be due to accidents comprised within the meaning of the Mining Acts, and a corrected list of the names and addresses of the different mine owners or companies, their agents, managers, and under-managers.

I have, &c.,

THOMAS BELL,
H.M. Inspector of Mines.

To the Right Honourable
H. H. Asquith, Q.C., M.P.,
Secretary of State, Home Department,
Whitehall, S.W.

SCHEDULE A.

The following Table is a summary of the tons of mineral raised, the number of persons of different ages employed, with a comparison for the preceding year, for the coal and ironstone mines in the Durham district:—

1893.	South Durham.	Westmoreland.	Yorkshire, North Riding.	Total, 1893.	Total, 1892.
Mineral raised in statute tons:	Tons.	Tons.	Tons.	Tons.	Tons.
Coal	21,822,702	1,113	3,974	21,827,789	16,965,030
Fire-clay	276,519	—	—	276,519	179,176
Ironstone	—	—	4,625,520	4,625,520	3,411,400
Shale	—	—	—	—	—
Other minerals	—	—	—	—	—
Total, 1893	22,099,221	1,113	4,629,494	26,729,828	—
Total, 1892	17,138,435	1,364	3,415,807	—	20,555,606
Persons employed underground:					
Boys of 12 to 16 years of age	4,216	3	165	4,384	4,338
Males above 16 years of age	49,255	15	4,017	53,287	52,480
Total underground, 1893	53,471	18	4,182	57,671	—
Total underground, 1892	52,309	12	4,417	—	56,818
Persons employed above ground:					
Boys of 12 to 13 years of age	1	—	—	1	—
Girls of 12 to 13 years of age	—	—	—	—	—
Boys of 13 to 16 years of age	1,755	—	48	1,803	1,886
Girls of 13 to 16 years of age	—	—	—	—	—
Females above 16 years of age	5	—	—	5	5
Males above 16 years of age	11,114	2	1,021	12,137	11,989
Total above ground, 1893	12,875	2	1,069	13,946	—
Total above ground, 1892	12,860	2	1,018	—	13,880
Total number of persons employed in and about the mines in 1893.	66,346	20	5,251	71,617	—
Total number of persons employed in and about the mines in 1892.	65,249	14	5,435	—	70,698

SCHEDULE B.

The following Table is a summary of the tons of mineral raised and the number of persons of different ages employed, with a comparison for the preceding year, for the metalliferous mines in the Durham district :—

Mineral raised 1893.	Durham.	Westmoreland.	North Riding of Yorkshire.	Totals in 1893.	Totals in 1892.
	Tons Cwt.	Tons Cwt.	Tons Cwt.	Tons Cwt.	Tons Cwt.
Lead ore, dressed - - -	9,124 1	1,500 16¼	635 18	11,260 15¼	8,577 16
„ undressed - -	—	—	—	—	—
Copper ore - - -	—	—	—	—	18 0
Barytes - - - -	357 3	258 0	362 0	977 3	1,305 11
Iron ore - - - -	—	—	—	—	9,275 0
Green roofing slate, dressed -	—	1,666 15	—	1,666 15	1,252 10
Whinstone - - - -	416 10	—	76,076 6	76,492 16	55,196 0
Sandstone, slate and flags -	835 9	—	13,527 0	14,362 9	14,877 15½
Blocks, curbs, sills, and rubble -	—	—	—	—	—
Ganister or firestone - -	4,105 9	—	376 0	4,481 9	4,363 11
Limestone - - -	—	—	—	—	—
Gypsum - - - -	—	4,199 0	—	4,199 0	5,398 0
Jet - - - -	—	—	0 8	0 8	0 8¼
Fluor Spar - - -	8 0	—	—	8 0	—
Totals for 1893 - -	14,846 12	7,624 11¼	90,977 12	113,448 15¼	—
„ 1892 - -	21,023 7½	8,680 10	70,560 14¼	—	100,264 11¾
Salt made from brine, pumped from boreholes.	241,020 0	—	48,178 0	289,198 0	231,060 0
Persons employed—Underground.					
Boys of 12 to 13 years of age -	—	—	—	—	—
Male young persons of 13 to 16 years of age.	—	—	10	10	13
Males above 16 years of age -	733	149	314	1,196	1,226
Total underground, 1893 -	733	148	324	1,206	—
„ „ 1892 -	676	180	383	—	1,239
Persons employed—Above Ground.					
Boys of 10 to 13 years of age -	4	—	—	4	2
Girls of 10 to 13 years of age -	—	—	—	—	2
Male young persons of 13 to 18 years of age.	198	22	19	239	249
Female young persons of 13 to 18 years of age.	14	—	—	14	28
Females above 18 years of age -	3	—	2	5	3
Males „ „ -	773	144	251	1,168	1,065
Total above ground, 1893 -	992	166	272	1,430	—
„ „ 1892 -	881	154	314	—	1,349
Total number of persons employed in and about the mines in 1893	1,725	315	596	2,636	—
„ „ 1892 -	1,557	334	697	—	2,588

SCHEDULE C.

The following are the usual Tables given in these Reports showing the number of fatal accidents, and deaths resulting therefrom, for the year under notice, in the two portions of the district under the Coal Mines Regulation Act, and showing the average for the five preceding years:—

Coal Mines.	Number of separate Fatal Accidents. Years and Averages.							Number of Deaths resulting. Years and Averages.						
	1888.	1889.	1890.	1891.	1892.	Average of Five Years.	1893.	1888.	1889.	1890.	1891.	1892.	Average of Five Years.	1893.
EXPLOSIONS OF FIRE-DAMP	—	—	—	—	—	—	2	—	—	—	—	—	—	2
FALLS IN MINE.														
Falls of sides	5	5	3	3	3	3·8	8	5	5	3	3	3	3·8	8
Falls of roof	34	33	27	33	22	29·8	25	34	34	27	34	23	30·4	26
Total falls in mine	39	38	30	36	25	33·6	33	39	39	30	37	26	34·2	34
IN SHAFTS.														
Overwinding	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Ropes and chains breaking	—	—	—	—	—	—	1	—	—	—	—	—	—	4
Whilst ascending or descending by machinery.	—	1	1	1	—	·6	2	—	2	1	1	—	·8	2
Falling into shaft from surface	—	1	—	—	2	·6	—	—	1	—	—	2	·6	—
Things falling from surface	—	—	—	1	—	·2	—	—	—	—	2	—	·4	—
Falling from part way down	1	1	1	1	2	1·2	1	1	1	1	1	2	1·2	1
Things falling from part way down	1	—	—	—	—	·2	—	1	—	—	—	—	·2	—
Miscellaneous in shafts	—	1	1	3	—	1·0	2	—	1	1	3	—	1·0	2
Total in shafts	2	4	3	6	4	3·8	6	2	5	3	7	4	4·2	9
MISCELLANEOUS UNDERGROUND.														
Explosions of gunpowder, &c.	1	3	3	—	2	1·8	1	1	3	3	—	2	1·8	1
Suffocation by gases	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Irruptions of water	—	—	1	—	—	·2	—	—	—	1	—	—	·2	—
Falling into water	—	—	—	—	—	—	—	—	—	—	—	—	—	—
On incline and engine planes	10	6	6	8	4	6·8	3	10	6	6	8	4	6·8	3
By trams and tubs	12	10	11	6	3	8·4	13	12	10	11	6	3	8·4	13
By machinery underground	1	1	—	2	—	·8	—	1	1	—	2	—	·8	—
Sundries underground	3	7	1	3	2	3·2	1	3	7	1	3	2	3·2	1
Total miscellaneous underground	27	27	22	19	11	21·2	18	27	27	22	19	11	21.2	18
Total underground	68	69	55	61	40	58·6	59	68	71	55	63	41	59·6	63
ON SURFACE.														
By machinery on surface	2	—	—	—	1	·6	1	2	—	—	—	1	·6	1
By boilers bursting	1	1	—	—	—	·4	—	1	1	—	—	—	·4	—
Railway sidings at the mine	3	5	—	2	2	2·4	1	3	5	—	2	2	2·4	1
Miscellaneous on surface	1	4	3	5	1	2·8	2	1	6	3	5	1	3·2	2
Total on surface	7	10	3	7	4	6·2	4	7	12	3	7	4	6·6	4
GROSS TOTALS	75	79	58	68	44	64·8	63	75	83	58	70	45	66·2	67

SCHEDULE D.

A similar table to the foregoing, giving details as to the Cleveland portion of the district :—

Ironstone Mines.	Number of separate Fatal Accidents. Years and Averages. 1888.	1889.	1890.	1891	1892.	Average of Five Years.	1893.	Number of Deaths resulting. Years and Averages. 1888.	1889.	1890.	1891.	1892.	Average of Five Years.	1893.
Explosions of Firedamp	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Falls in Mine.														
Falls of sides	4	2	3	3	4	3·2	2	4	2	3	3	4	3·2	2
Falls of roof	4	3	5	6	2	4·0	3	4	3	5	6	2	4·0	3
Total falls in mine	8	5	8	9	6	7·2	5	8	5	8	9	6	7·2	5
In Shafts.														
Overwinding	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Ropes and chains breaking	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Whilst ascending or descending by machinery.	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Falling into shaft from surface	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Things falling from surface	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Falling from part way down	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Things falling from part way down	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Miscellaneous in shafts	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total in shafts	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Miscellaneous Underground.														
Explosions of gunpowder, &c.	2	—	—	2	1	1·0	2	2	—	—	2	1	1·0	2
Suffocation by gases	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Irruptions of water	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Falling into water	—	—	—	—	—	—	—	—	—	—	—	—	—	—
On incline and engine planes	—	—	—	1	1	·4	2	—	—	—	1	1	·4	2
By trams and tubs	3	—	—	1	—	·8	—	3	—	—	1	—	·8	—
By machinery underground	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sundries underground	—	—	—	—	1	·2	—	—	—	—	—	1	2	—
Total miscellaneous underground	5	—	—	4	3	2·4	4	5	—	—	4	3	2·4	4
Total underground	13	5	8	13	9	9·6	9	13	5	8	13	9	9·6	9
On Surface.														
By machinery on surface	—	—	—	—	—	—	—	—	—	—	—	—	—	—
By boilers bursting	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Railway sidings at the mine	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Miscellaneous on surface	1	—	1	—	—	·4	—	1	—	1	—	—	·4	—
Total on surface	1	—	1	—	—	·4	—	1	—	1	—	—	·4	—
Gross Totals	14	5	9	13	9	10·0	9	14	5	9	13	9	10·0	9

SCHEDULE E.

MINES classed under the COAL MINES REGULATION ACT, 1887.

List of the FATAL ACCIDENTS, and DEATHS arising therefrom within one Year and a Day from the Date of the ACCIDENTS in MR. BELL'S DISTRICT, comprising SOUTH DURHAM, WESTMORELAND, and the NORTH RIDING of the COUNTY of YORK, during the Year 1893.

No. of Accident.	Date and Hour of the Accident.	Hour of the Person's Shift, i.e., No. of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Fire-damp.	Lives lost. Falls of Roof and Sides.	Lives lost. In Shafts.	Lives lost. Miscellaneous Underground.	Lives lost. Above Ground.	Lives lost. Total.
1	1893. Jan. 3 11.15p.m.	5	Holmside -	Chester-le-Street	Hedley Bros. -	Alfred Thompson -	44	Fireman -	He had a cage suspended on a chock until he cleared away some ice; the timber broke and the cage fell upon him.	–	–	1	–	–	1
2	Jan. 5 11.45p.m.	5	South Durham	Auckland -	South Durham Coal Co.	Ralph Simpson -	45	Hewer -	Fall of coal and stone from a slip in Longwall working.	–	1	–	–	–	1
3	Jan. 13 12.30p.m.	7	Houghton -	Fence Houses -	Earl of Durham -	Thos. E. Moran -	13	Driver -	Tub got off the way at a curve, and crushed his head against a prop.	–	–	–	1	–	1
4	Jan. 16 1.30 p.m.	8	Broompark -	Durham - -	North Brancepeth Coal Co., Limited.	Arthur Graham -	13	Screen boy	He climbed over a rail fence on pit heap and fell on to truck way. Died a few hours after.	–	–	–	–	1	1
5	Feb. 6 1.0 p.m.	4	Auckland Park	Auckland -	Bolckow, Vaughan, & Co., Limited.	J. T. Pearson -	16	Shifter -	While waiting at a station he heard a stone fall close to him. He ran to escape it, and met a full tub, which crushed him between it and a prop.	–	–	–	1	–	1
6	Feb. 8 9.30 p.m.	6	East Hetton -	Coxhoe - -	Walter Scott, Limited	George Gibson -	38	Timberman	While setting a safety prop preparatory to drawing some chocks a large stone fell from between two slips.	–	1	–	–	–	1

List of Fatal Accidents—*continued.*

No. of Accident.	Date and Hour of the Accident.	Hour of the Person's Shift, *i.e.*, No. of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Fire-damp.	Lives lost. Falls of Roof and Sides.	Lives lost. In Shafts.	Lives lost. Miscellaneous Underground.	Lives lost. Above Ground.	Lives lost. Total.
7	1893. Feb. 9 9.0 a.m.	3	Littleburn	Durham	North Brancepeth Coal Co., Limited.	William Emery	18	Putter	He was hewing coal from the side of a road where he had no business, and a large stone fell upon him.	–	1	–	–	–	1
8	Feb. 15 3.0 a.m.	6	Tudhoe	Spennymoor	Weardale Iron Co., Limited.	Richard Clish	57	Deputy	Fall of a large stone while engaged drawing timber out of a broken jud.	–	1	–	–	–	1
9	Feb. 15 3.15 p.m.	6	Low Beechburn	Crook	Low Beechburn Coal Co., Limited.	George Hodge	34	Hewer	Fall of stone which came off at a slip and canted out some props.	–	1	–	–	–	1
10	Feb. 15 11.45 a.m.	6	Murton	Sunderland	South Hetton Coal Co., Limited.	John T. Shield	63	Engineer	Fingers severely crushed while examining machinery. Died from blood poisoning on March 4th.	–	–	–	–	1	1
11	Feb. 26 8.45 a.m.	5	Ditto	Ditto	Ditto	Robert Short	37	Shifter	Fall of coal and stone while repairing gateway. The fall canted some props out.	–	1	–	–	–	1
12	Mar. 6 3.0 p.m.	6	West Auckland	Auckland	Bolckow, Vaughan, & Co., Limited.	Jos. Swinbank	13	Water leader	Some tubs were running into a landing and caught a hauling rope attached to a tub, which was dragged over him.	–	–	–	1	–	1
13	Mar. 20 6.30 a.m.	3	Dorothea	Fence Houses	Earl of Durham	John Appleton	29	Hewer	While hewing in a jud he exposed a slip, and a fall of stone took place, killing him.	–	1	–	–	–	1
14	Apr. 26 6.45 a.m.	1	Wingate Grange	Wingate	Owners of Wingate Grange Colliery	William Clennel	16	Landing boy	Engine set got off the way, which caught and crushed him to death.	–	–	–	1	–	1

List of Fatal Accidents—*continued.*

No. of Accident.	Date and Hour of the Accident.	Hour of the Person's Shift, i.e., No. of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.	Total.
15	1893. Apr. 26 11.0 a.m.	5	Murton -	Sunderland -	South Hetton Coal Co., Limited.	Edward Hart -	12	Trapper -	Took away a driver's tub and pony, which he had no right to do, and got his head crushed between the top of tub and roof.	–	–	–	1	–	1
16	Apr. 29 1.0 a.m.	7	Black Boy -	Auckland -	Bolckow, Vaughan, & Co., Limited.	Robert Burns -	20	Putter -	Concussion of brain, caused by a stone being thrown from a gelatine shot. Died on the 23rd May.	–	–	–	1	–	1
17	Apr. 29 5.30 a.m.	4	Seaham -	Sunderland -	Marquess of Londonderry.	Jos. Haswell -	23	Hewer -	Severe injury to spine by fall of stone. Died on 15th August.	–	1	–	–	–	1
18	May 1 8.0 a.m.	4	Eppleton -	Fence Houses -	Hetton Coal Co., Limited.	Joseph Stokoe -	16	Driver -	Horse fell, which ended tub up and crushed him to death.	–	–	–	1	–	1
19	May 1 4.0 p.m.	7	Croxdale -	Durham -	Weardale Iron Co., Limited.	Joseph Curry -	41	Hewer -	While assisting a deputy to draw out a broken jud a large stone fell from the roof and killed him.	–	1	–	–	–	1
20	May 3 6.0 p.m.	8	West Auckland	Auckland -	Bolckow, Vaughan, & Co., Limited.	James Halfpenny -	38	Deputy -	Sudden fall of a broken jud while engaged removing the timber.	–	1	–	–	–	1
21	May 5 11.15a.m.	6	Lady Durham	Durham - -	Earl of Durham -	Thos. Golightly -	14	Driver -	Neglecting to put the cotter into limber's bolt, they became detached from the set and he fell before the tubs and was run over.	–	–	–	1	–	1

List of Fatal Accidents—*continued.*

No. of Accident.	Date and Hour of the Accident.	Hour of the Person's Shift, i.e., No. of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.	Total.
22	1893. May 11 6.15 p.m.	–	Framwellgate	Durham -	Framwellgate Coal Co., Limited.	Benj. P. Taylor -	36	Hewer -	Engaged filling a tub on the 3rd November 1892, when a piece of coal fell and severely cut his thumb. He was never able to work afterwards, and died from the effects.	–	1	–	–	–	1
23	May 19 4.0 p.m.	3	Seaham -	Sunderland -	Marquess of Londonderry.	John C. Greener -	16	Driver -	Died from rupture of one of the pulmonary arteries, caused by a strain while lifting a tub on the way on 5th August 1892.	–	–	–	1	–	1
24	June 2 3.45 p.m.	10	Houghton -	Fence Houses -	Earl of Durham -	Matthew R. Ferguson.	13	Doorkeeper	Crushed while attempting to get on an engine set of tubs, contrary to orders.	–	–	–	1	–	1
25	June 19 11 p.m.	3	Deaf Hill -	Trimdon -	Trimdon Coal Co. -	Clement Minto -	38	Stoneman -	While engaged enlarging shaft siding a large piece of side stone fell from a breaker.	–	1	–	–	–	1
26	June 27 5.30 a.m.	8	Wingate Grange.	Wingate -	Owner of Wingate Grange Colliery.	Wm. Bainbridge -	73	Pumpman -	Alleged to have fallen off the kip and injured himself in May last.	–	–	–	1	–	1
27	June 28 2.15 a.m.	8	Hazard -	Fence Houses -	North Hetton Coal Co.	Wm. S. Bond -	36	Stoneman -	While ascending in a cage he was seen to fall forward and was crushed to death between cage and shaft bunton. He probably fainted.	–	–	1	–	–	1
28	June 30 9.0 a.m.	3	Butterknowle	Cockfield -	Butterknowle Coal Co., Limited.	Joseph Tarn -	22	Hewer -	Hands and face burnt by explosion of gas. He passed two caution boards and a fence with a naked light. Died 10th July.	1	–	–	–	–	1

List of Fatal Accidents—*continued.*

No. of Accident.	Date and Hour of the Accident.	Hour of the Person's Shift, *i.e.*, No. of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.	Total.
29	1893. July 27 2.0 a.m.	8	Sherburn House.	Durham	Earl of Durham	Robt. Wm. Dixon	19	Putter	While hewing off side of place, in doing which he was wrong, a side waver of stone fell over and injured him internally. He died on 10th inst.	–	1	–	–	–	1
30	July 7 1.30 p.m.	8	Esh	Ditto	Pease and Partners, Limited.	Thos. Hodgson	32	Deputy	Engaged drawing the timber out from a broken jud, when a sudden fall of roof took place.	–	1	–	–	–	1
31	July 18 11.0 a.m.	2	Tudhoe	Spennymoor	Weardale Iron Co., Limited.	John Edwards	48	Hewer	Severe injury to back by fall of stone. Died on the 21st inst.	–	1	–	–	–	1
32	July 22 11.45 p.m.	8	Sacriston	Durham	Charlaw Coal Co., Limited.	Jos. Emmerson	23	Stoneman	Severe injuries to head by fall of stone.	–	1	–	–	–	1
33	July 26 10.15 p.m.	3	Hamsteels	Ditto	Executors of late J. Johnson.	John Worthington	66	Hewer	A sudden fall of his broken jud took place and he was caught by it before he could reach a place of safety.	–	1	–	–	–	1
34	July 28 11.0 a.m.	9	Langley Park	Witton Gilbert	Consett Iron Co., Limited.	Wm. Crossmore	60	Shifter	While ascending the shaft he carelessly reached out of the cage for some purpose, and his head was crushed between the cage bar and the shaft arching.	–	–	1	–	–	1
35	Aug. 4 1.0 p.m.	9	Murton	Sunderland	South Hetton Coal Co., Limited.	Wm. Hy. Simms	12	Driver	Severely crushed about abdomen by being run over by tubs. Died on 8th inst.	–	–	–	1	–	1
36	Aug. 8 10.0 a.m.	6	Sherburn House.	Durham	Earl of Durham	John Williamson	44	Hewer	Fall of a very large stone whilst at his work in an ordinary "bord."	–	1	–	–	–	1

List of Fatal Accidents—*continued*.

No. of Accident.	Date and Hour of the Accident.	Hour of the Person's Shift, *i.e.*, No. of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.	Total.
37	1893. Aug. 9 8.30 a.m.	4	Seaham -	Sunderland -	Marquess of Londonderry.	Wm. Thos. Williams	14	Driver -	A pony's limbers became detached on an incline, and the tubs ran amain, crushing deceased against a prop. It transpired one boy neglected to put in his cotteril, and deceased to put in a chock.	–	–	–	1	–	1
38	Aug. 19 4.30 a.m.	2	Croxdale -	Durham -	Weardale Iron Co., Limited.	Chas. Robinson - Jas. Hunter -	22 23	Hewer - Ditto.	While taking off a loose end broken jud the roof suddenly fell. They had no doubt removed some timber.	–	2	–	–	–	2
39	Sept. 6 9.15 a.m.	5	Murton -	Sunderland -	South Hetton Coal Co., Limited.	George Cowley -	13	Driver -	Head crushed between tub and prop.	–	–	–	1	–	1
40	Sept. 19 8.40 a.m.	3	Sherburn House.	Durham -	Earl of Durham -	Wm. Spedding -	17	Putter -	Was sent to hew coal in a broken jud. He neglected to set necessary sprags, and the coal fell from a breaker and killed him.	–	1	–	–	–	1
41	Sept. 27 10.0 a.m.	2	Rainton -	Fence Houses -	Marquess of Londonderry.	G. W. Young -	32	Hewer -	Fall of roof while engaged getting coal.	–	1	–	–	–	1
42	Oct. 3 3.30 a.m.	1	New Copley -	Cockfield -	Woodland Coal Co., Limited.	Simeon Harker -	42	Stoneman -	While working on engine plane, a fall of side stone suddenly took place; it had evidently been shaken by a shot.	–	1	–	–	–	1

List of Fatal Accidents—*continued.*

No. of Accident.	Date and Hour of the Accident.	Hour of the Person's Shift, i.e., No. of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Firedamp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.	Total.
43	1893. Oct. 7 11.0a.m.	3	Ushaw Moor -	Durham -	Henry Chaytor -	Thomas Bell -	43	Engineman	Severe scalds on body and limbs, also dislocated shoulder, caused by dome of locomotive coming in contact with screen and breaking it off. The switches had been set wrong. Died from the effects on 8th inst.	–	–	–	–	1	1
44	Oct. 11 9.0 a.m.	3	Castle Eden -	Castle Eden -	Castle Eden Coal Co., Limited.	Thomas Parkin -	36	Onsetter -	Failing to sprag some tubs, which were running towards the shaft, he tried to stop them, but was dragged into the cage hole and crushed to death.	–	–	1	–	–	1
45	Oct. 13 12 noon	6	East Hetton -	Coxhoe -	Walter Scott, Limited	Thomas Walker -	40	Back-over-man.	Severe injury to spine by fall of stone. Died on 18th inst.	–	1	–	–	–	1
46	Oct. 17 9.30 a.m.	4	Harraton -	Chester-le-Street	Earl of Durham -	Ralph Crowe -	16	Driver -	While driving a set of tubs outbye, he fell off the limbers and was run over.	–	–	–	1	–	1
47	Nov. 1 10.0 a.m.	4	Midridge -	Auckland -	Weardale Iron Co., Limited.	William Stones -	36	Hewer -	Fall of stone and coal at a breaker by the side of an old crosscut.	–	1	–	–	–	1
48	Nov. 2 3.40 p.m.	7	Herrington -	Fence Houses -	Earl of Durham -	Francis Salthouse -	43	Ditto -	Was caught by the full set of tubs while passing through between them at a landing.	–	–	–	1	–	1
49	Nov. 3 9.30 a.m.	6	Brancepeth -	Willington -	Strakers and Love -	Wm. Redhead -	48	Ditto -	Broken leg by fall of top coal and jet. Leg amputated. Died on 13th.	–	1	–	–	–	1

List of Fatal Accidents—*continued.*

No. of Accident.	Date and Hour of the Accident.	Hour of the Person's Shift, i.e., No. of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.	Total.
50	1893. Nov. 3 9.30 p.m.	2	Ushaw Moor -	Durham -	Henry Chaytor -	Thomas Gill -	50	Wasteman	Fall of stone while wedging it down.	–	1	–	–	–	1
51	Nov. 6 5.30 a.m.	2	Framwellgate	Ditto -	Framwellgate Coal Co., Limited.	William Willis -	32	Sinker -	While descending the shaft, with some deals, on the top of the cage, it struck the side, overbalancing him, and he fell to the bottom, about 120 yards.	–	–	1	–	–	1
52	Nov. 14 1.0 a.m.	3	Ryhope -	Sunderland -	Ryhope Coal Co., Limited.	Jonathan Watson -	57	Stoneman -	A sudden fall of stone took place while he was renewing timber in a new landing.	–	1	–	–	–	1
53	Nov. 21 12.50p.m.	4	Deaf Hill -	Trimdon -	Trimdon Coal Co. -	Michael McMahon	51	Hewer -	Broken thigh, injury to back, and other bruises by a fall of stone. Died on the 25th.	–	1	–	–	–	1
54	Nov. 22 8.0 a.m.	3	Eppleton -	Fence Houses -	Hetton Coal Co., Limited.	John G. Rowntree	15	Driver -	Run over by a set of full tubs on a self-acting incline. He left the refuge, where he would have been safe, too soon.	–	–	–	1	–	1
55	Nov. 23 9.15 p.m.	1	Burnhope -	Lanchester -	U. A. Ritson -	George Holt - Aaron Laycock - John Hall - George Shaw -	60 41 31 23	Master Shifter. Shifter. Ditto. Ditto.	While descending the Fell pit, the winding rope broke, when they had got about 30 yards from the surface, and they all fell to the bottom of the pit, about 150 yards.	–	–	4	–	–	4
56	Nov. 25 4.30 a.m.	3	Haswell -	Sunderland -	Haswell Coal Co., Limited.	James Spooner -	32	Hewer -	Sudden fall of roof while he was at work.	–	1	–	–	–	1

List of Fatal Accidents—*continued.*

No. of Accident.	Date and Hour of the Accident.	Hour of the Person's Shift, *i.e.*, No. of hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost.					
										Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.	Total.
57	1893. Nov. 30 1.0 p.m.	3	Lutterington -	Auckland -	Thomas Boddy -	Geo. Cuthbert Bainbridge.	23	Hewer -	Severely crushed by fall of coal. Died on December 3rd.	–	1	–	–	–	1
58	Dec. 2 9.0 a.m.	3	Newfield -	Ditto -	Bolckow, Vaughan, & Co., Limited.	Wm. W. Richardson	29	Fireman -	Passing along the branches on a locomotive engine he was struck by a plank projecting from a waggon and was thrown off.	–	–	–	–	1	1
59	Dec. 8 10.15a.m.	1	Wooley -	Crook -	Pease and Partners, Limited.	Hilton Humes -	29	Hewer -	Burnt by gas in a siding over place. Died on the 11th inst.	1	–	–	–	–	1
60	Dec. 16 12.40a.m.	4	Brancepeth -	Willington -	Strakers and Love -	Joseph Rawlings -	25	Ditto -	Broken back and other serious injuries by fall of stone which came off at a slip unobserved. Died on the 17th.	–	1	–	–	–	1
61	Dec. 22 10.0 a.m.	5	Seaham -	Sunderland -	Marquess of Londonderry.	C. W. Sharp -	21	Putter -	Sprained side by tub ending up on him, which produced inflammation of the spine. Died on the 26th.	–	–	–	1	–	1
62	Dec. 22 8.50 p.m.	6	North Beechburn.	Crook - -	North Beechburn Coal Co., Limited.	Henry Richardson	26	Hewer -	Fall of top coal while engaged taking off side coal. He met with a breaker.	–	1	–	–	–	1
63	Dec. 26 12.30p.m.	2	Hutton Henry	Wingate -	Hutton Henry Coal Co., Limited.	Mark Racey -	43	Ditto -	Sudden fall of stone while working in a broken jud. He met with a breaker which could not be seen.	–	1	–	–	–	1
									Total deaths under the Act -	2	34	9	18	4	67

List of Fatal Accidents, and Deaths arising therefrom, of Persons employed, on Private Branch Railways and Tramways, and in Washing and Coking Coal on Premises adjoining to or belonging to the Mines.

No. of Accident.	Date and Hour of the Accident.	Hour of the Person's Shift, i.e., No. of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.	Total.
									Brought forward	2	34	9	18	4	67
1	1893. Jan. 30 1.0 a.m.	5	East Hetton	Coxhoe	Walter Scott, Limited	William Peat	17	Locomotive Fireman.	Got his foot fast in a crossing. Several waggons ran over and took his leg off. He died shortly after.	–	–	–	–	1	1
2	Sept. 1 1.5 p.m.	4	Murton	Sunderland	South Hetton Coal Co., Limited.	William Knox	38	Joiner	While engaged erecting a coal washer he fell off a staging, 20 feet high, causing concussion of the brain, from which he shortly afterwards died.	–	–	–	–	1	1
3	Nov. 18 10.30a.m.	6	Lumley	Fence Houses	Earl of Durham	Wm. Robt. Barnard	25	Waggonman	While guiding some full waggons along a siding he fell, and his leg was broken, and afterwards amputated, but he died a few hours after.	–	–	–	–	1	1
4	Dec. 1 10.45a.m.	5	South Hetton	Sunderland	South Hetton Coal Co., Limited.	John Purdy	34	Traffic Manager.	While attempting to sprag some waggons on an incline, the sprag flew out, striking him on the head, and dislocating his neck.	–	–	–	–	1	1
									Totals	–	–	–	–	4	4
									Gross total deaths	2	34	9	18	8	71

SCHEDULE F.

MINES CLASSED UNDER THE COAL MINES REGULATION ACT, 1887.

LIST of the FATAL ACCIDENTS, and DEATHS arising therefrom within One Year and a Day from the Date of the Accident, in the CLEVELAND IRONSTONE portion of MR. BELL'S DISTRICT, during the Year 1893.

No. of Accident.	Date and Hour of the Accident.	Hour of the Person's Shift, i.e., No. of Hours he had been at work when the Accident happened to him.	Name of the Mine.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Fire-damp.	Lives lost. Falls of Roof and Sides.	Lives lost. In Shafts.	Lives lost. Miscellaneous Underground.	Lives lost. Above Ground.	Lives lost. Total.
1	1893. Feb. 27 12 noon	6	North Skelton	Skelton	Bolckow, Vaughan, & Co., Limited.	William Brown	22	Fitter	He was walking on an incline, and stepped out of the way of the empty set, but, in doing so, got in front of the full set and was severely injured. He was afterwards attacked by scarlet fever, and died on 3rd March.	–	–	–	1	–	1
2	Mar. 9 1.0 p.m.	7	Eston	Middlesbro'	Ditto	William Boyes	37	Miner	While engaged filling a tub, a piece of stone suddenly fell from the top and killed him.	–	1	–	–	–	1
3	Mar. 20 8.45 a.m.	3	Ditto	Ditto	Ditto	Henry Walker	44	Ditto	While barring down stone a piece suddenly fell away from the top part of the seam and hit him on the head and back, injuring him so severely that he died in a few minutes.	–	1	–	–	–	1
4	Aug. 2 10.45 a.m.	5	Grinkle	Mulgrave	Palmer & Co., Ltd.	James Green	56	Deputy	While barring down some loose top stone the bar slipped, and he felt the stone falling, which caught him and fractured his skull.	–	1	–	–	–	1
5	Aug. 9 4.0 p.m.	10	Eston	Middlesbro'	Bolckow, Vaughan, & Co., Limited.	Robert Jas. Copping	27	Incline-man	A full tub became uncoupled on an incline and ran back, crushing him in such a manner that he died a few hours after.	–	–	–	1	–	1

List of Fatal Accidents—*continued*.

No. of Accident.	Date and Hour of the Accident.	Hour of the Person's Shift *i.e.*, No. of Hours he had been at work when the Accident happened to him.	Name of the Mine.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost.					
										Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.	Total.
6	1893. Sept. 11 5.0 p.m.	4	Upleatham -	Marske -	Pease and Partners, Limited.	Morris Broham -	51	Deputy -	While preparing to set a prop a large stone from the roof fell on him.	–	1	–	–	–	1
7	Oct. 12 1.0 p.m.	7	Rosedale -	Rosedale -	Carlton Iron Co., Limited.	Wm. Abbot -	42	Miner -	Head cut and other injuries by a shot blowing through from an adjoining place. Died on the 14th.	–	–	–	1	–	1
8	Oct. 24 6.0 p.m.	5	Lofthouse -	Loftus - -	Pease and Partners, Limited.	Geo. Cornall -	47	Deputy -	Severely cut on face and head by a shot blowing through from another place. Died on the 29th.	–	–	–	1	–	1
9	Dec. 7 12.0 a.m.	6	Eston - -	Middlesbro' -	Bolckow, Vaughan, & Co., Limited.	John Carey -	34	Miner -	Sudden fall of stone without warning	–	1	–	–	–	1
									Totals - -	–	5	–	4	–	9

SCHEDULE G.

MINES CLASSED UNDER THE METALLIFEROUS MINES REGULATION ACTS, 1872 AND 1875.

LIST of the FATAL ACCIDENTS, and DEATHS arising therefrom within one YEAR and a DAY from the Date of the ACCIDENT, in MR. BELL'S DISTRICT, comprising the Counties of DURHAM and WESTMORELAND, and the NORTH RIDING of the COUNTY of YORK, during the Year 1893.

No. of Accident.	Date and Hour of the Accident.	Hour of the Person's Shift, i.e., No. of Hours he had been at work when the Accident happened to him.	Name of the Mine.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost.					
										Explosions of Fire-damp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.	Total.
						Nil.									

SCHEDULE H.

The following DEATHS occurring to PERSONS employed in or about the MINES have been reported to me during the Year 1893, for the DURHAM DISTRICT, and were found, on investigation, not to be due to ACCIDENTS comprised within the MINING ACTS.

No. of Accident or Death.	Date and Hour of the Accident or Death.	Hour of the Person's Shift, i.e., No. of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Total Deaths.
1	1893. Feb. 13 9.0 a.m.	4	Norwood -	Evenwood -	Norwood Colliery Co. -	Matthew Bowman-	23	Hewer -	Found dead in the pit. He had suffered from heart disease for some time, and it is supposed this was the cause of death. The ventilation of mine at this place was good.	1
2	Feb. 21 10.45p.m.	1	Murton -	Sunderland -	South Hetton Coal Co., Limited.	Martin Dickinson -	33	Ditto -	Died from natural causes on the engine plane while going to his work.	1
3	Mar. 20	—	Tudhoe -	Spennymoor -	Weardale Iron Co., Limited	Thos. Minhinnet -	55	Ditto -	Died to-day from an injury to knee received on the 11th November 1891 while at work.	1
4	Apr. 5	—	Haswell -	Sunderland -	Haswell Coal Co., Limited	Robt. Hollidoy -	68	Shifter -	Alleged to have died from effects of injury received on 26th August last by a fall of stone. Death was due to acute pneumonia, and not the accident.	1
5	„ 17	—	Wooley -	Crook -	Pease & Partners, Limited	Benj. Smith -	28	Runner -	He was injured on the shoulder by slipping his foot on gangway on 1st instant, and died to-day, but the doctor certified death was due to influenza and inflammation of the brain, and no inquest was therefore held.	1
6	May 2	—	Lutterington -	Auckland -	Thomas Boddy - -	Thomas Gill -	40	Hewer -	Was found dead in working place. He had been attended for some time by a doctor for heart disease. The ventilation of pit all right.	1
7	„ 12	—	Lumley -	Fence Houses -	Earl of Durham - -	James Dixon -	16	Labourer -	Employed at brickworks. On returning home after his day's work he attempted to get on a set of waggons, but was thrown down and run over. He was a trespasser on this line.	1
8	July 6	—	Medomsley -	Medomsley -	Consett Iron Co., Limited	Robert Stoddart -	24	Hewer -	Died to-day from injuries received by a fall of stone on August 25th, 1891.	1

List of Deaths—*continued.*

No. of Accident or Death.	Date and Hour of the Accident or Death.	Hour of the Person's Shift, *i.e.*, No. of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Total Deaths.
9	1893. July 20	—	Browney	Durham	Bell Brothers, Limited	Thos. McNamara	43	Hewer	Took ill in the pit while at his work, and died from heart disease.	1
10	" 30	—	Ludworth	Ditto	Weardale Iron Co., Limited	John Taylor	57	Labourer	Died in hospital to-day from alleged injuries received to foot while emptying a tub of stone on refuse heap a month ago. No confirmatory evidence; it appears to be an old wound.	1
11	Aug. 5	—	Wingate Grange	Wingate	Owners of Wingate Grange Colliery.	Thomas Jones	26	Hewer	Died to-day from injuries received to back and legs by a fall of stone on the 28th May 1888. He was working nearer the goaf than ordered by overman.	1
12	" 5	—	Black Prince	Tow Law	Weardale Iron Co., Limited	Wilson Hogarth	64	Furnace-man	Died from heart disease while returning from his work. He had suffered from this complaint for some time.	1
13	" 31	—	Lady Ann	Fence Houses	Earl of Durham	Geo. T. Mason	41	Shifter	After finishing his shift, he had just reached home when he died suddenly from heart disease. He had suffered from this complaint for some months. Ventilation of pit all right.	1
14	Sept. 16	—	Pelton Fell	Chester-le-Street.	Lord Dunsaney and Partners.	John Carr	18	Incline boy	Alleged to have received an accident by falling. A post-mortem examination showed that death was caused by exhaustion from typhoid ulcers of the intestines.	1
15	" 19	—	Derwent	Medomsley	Consett Iron Co., Limited	Geo. Knox	25	Hewer	Died to-day from an alleged sprain to his arm while at work on the 13th instant. A post-mortem examination showed that he died from acute meningitis.	1
16	" 29	—	Sherburn	Durham	Earl of Durham	Mark Pratt	60	Shifter	Died from blood poisoning from alleged injuries to his arm. No evidence to show that he even received any accident or sprain in the mine.	1

List of Deaths—*continued.*

No. of Accident or Death.	Date and Hour of the Accident or Death.	Hour of the Person's Shift, *i.e.*, No. of Hours he had been at work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Total Deaths.
17	1893. Nov. 9	—	Margaret	Fence Houses	Earl of Durham	Richard Laidler	21	Wasteman	Died from injuries received from a fall of stone while drawing a prop on November 15th, 1890.	1
18	„ 16	—	Newfield	Auckland	Bolckow, Vaughan, & Co., Limited.	Wm. Gomersall	62	Hewer	Commenced spitting blood after his day's work, and died within a few hours. He was alleged to have sprained himself, but the doctor was of opinion that the cause of death was heart disease.	1
19	„ 30	—	Littletown	Durham	Earl of Durham	Thos. W. Grieveson	48	Shifter	He had just entered the pit and while passing along the siding he fell and died from natural causes. The ventilation and lighting of place was all right.	1
									Total - - - - -	19

Reports of Assistant Inspectors.

Sir, 22nd March 1894.

In accordance with the 20th section of the Metalliferous Mines Regulation Act, 1872, I have the honour to report that during the year 1893 I exercised the duties of an Inspector of Mines in the Durham District (No. 4) under the direction of Mr. Thomas Bell, the Chief Inspector. I also acted in the same district and under the same directions under the Coal Mines Regulation Act, 1887.

I have, &c.,
JOHN PLUMMER.

The Right Hon. H. H. Asquith, Q.C., M.P.,
Her Majesty's Principal Secretary of State,
Home Department, Whitehall.

Sir, Durham, March 1894.

In accordance with the 20th section of the Metalliferous Mines Regulation Act, 1872, I have the honour to report that during the year 1893 I acted as an Inspector of Mines in the Durham Inspection District (No. 4) under the directions of Mr. Thomas Bell, the Chief Inspector.

I also acted in the same district and under the same directions under the Coal Mines Regulation Act, 1887.

I have, &c.,
WM. WALKER.

The Right Hon. H. H. Asquith, Q.C., M.P.,
Her Majesty's Principal Secretary of State,
Home Department, Whitehall.

REPORT

OF

FRANK N. WARDELL, Esq., H.M. INSPECTOR OF MINES

FOR THE

YORKSHIRE AND LINCOLNSHIRE DISTRICT (No. 5),

TO

HER MAJESTY'S SECRETARY OF STATE,

UNDER

The Coal Mines Regulation Act, 1887,
the Metalliferous Mines Regulation Acts, 1872 and 1875,
and the Slate Mines (Gunpowder) Act, 1882;

For the Year 1893.

Presented to both Houses of Parliament by Command of Her Majesty.

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Mr. Wardell's Report.

Report on the Working of the Mines Regulation Acts in the Yorkshire and Lincolnshire District during the Year ended 31st December 1893. —By Frank N. Wardell, Esq., F.G.S.

Sir, Wath, March 1894.

I have the honour to present to you my Annual Report as Inspector of Mines in charge of the Yorkshire and Lincolnshire District.

The loss of life in this district during the year exhibits a great contrast when compared with that of last year, as it reached a total of 218.

A calamity of terrible magnitude at Combs Colliery, from an explosion of firedamp, involving the deaths of 139 persons, accounts for the exceptional result. We have been, comparatively, so free of late from such disasters that hopes were indulged in that they had ceased to occur. The more fiery portion of the district was not responsible for this calamity, for it happened in a locality comparatively free from accidents of such magnitude.

In the actual number of accidents there is a decrease of two compared with the previous year, and this notwithstanding the fact that in 1893 those accidents (numbering six) occurring on private branch railways and tramways, and in washing and coking coal, are included. The totals in the two years were 76 and 74 respectively. The deaths, on the other hand, which in 1892 amounted to 83, reached 218 in 1893, or an increase of 135.

There are two circumstances which make the year 1893 an exceptional one in this district. The first is the explosion I have referred to, and the other is the lamentable and disastrous dispute which practically closed the collieries for a period of four months. These facts must be borne in mind when comparing the different tables and proportions in this and previous years.

One other accident besides that to which I have alluded from explosion of firedamp was attended with fatal consequences, and resulted in a loss of three lives.

At Combs Colliery, as I have have said, 139 persons were killed from explosion of gas. At Sharlston Colliery three men lost their lives from the same cause. Three lives were lost in a sinking shaft at Warren House Colliery, and two persons were killed at Orgreave Colliery, and two at Queensbury Colliery from falls of roof. In the remaining 69 accidents a single death in each case was the result.

Next in order after the column in the lists which deals with explosions of firedamp, and in which is recorded a total of 142 deaths, comes that referring to "falls of roof and sides," and here, but for exceptional circumstances, is always to be found the most serious record of mortality. The loss of life from this cause amounted in 1893 to 37, the result of 35 separate accidents, the numbers in the previous year being 45 and 43 respectively. The percentage amounts to 16·99 of the total loss of life, whilst in the United Kingdom it was 38·87. Seven accidents in shafts produced nine deaths, compared with five deaths resulting from five accidents in the year preceding.

In the column representing deaths from miscellaneous accidents underground, 12 accidents caused 12 deaths. This is a considerable reduction as compared with 1892, the loss of life in that year amounting to 23, resulting from 18 accidents.

On the surface there were 18 accidents, causing one death in each case. In the previous year there were nine deaths. The increase here is, to some extent, accounted for by the inclusion of deaths on private branch railways and in washing and coking coal.

Owing to the long cessation from work which the collieries experienced during the year, a very material reduction from the year previous has to be recorded in the amount of mineral produced.

The output of coal in this district in 1893 was 15,951,843 tons. In the previous year it was 23,185,508 tons. A decrease is thus shown of 7,233,665 tons,

The amounts of fireclay raised in 1893 and 1892 were 190,271 and 243,101 tons respectively, or a decrease this year of 52,830 tons.

In 1893, 164,108 tons of ironstone were produced, whilst in the preceding year the quantity was 186,113 tons, representing a decrease of 22,005 tons.

The production of shale and other minerals in 1893 reached a total of 77,087 tons, exhibiting a reduction of 17,263 tons compared with the previous year, when the output was 94,350 tons.

Summing up, therefore, the total amount of mineral raised in 1893 being 16,383,309 tons, and that in the year preceding 23,709,072 tons it will be seen that there is the very large decrease of 7,325,763 tons.

If the number of persons engaged on private branch railways and washing and coking coal in 1892 be included there were in that year 89,046 persons employed in the production of the minerals. In 1893 the number was 88,699; a slight decrease (347) is here exhibited.

The total amount of mineral raised in the kingdom in 1893 was 175,236,857 tons, which is a reduction from the total in the previous year of 16,718,051 tons.

The number of lives lost in and about mines in the kingdom during 1893 was 1,060, or an increase of 44 over the number in 1892.

The number of persons employed in the production of the minerals in the kingdom was 683,008, including those on private branch railways and in washing or coking coal, which represents a decrease of 634 from the total number in the year preceding. A proportion is thus given of one death to every 644 persons employed, and 165,318 tons produced.

In this district, owing to the circumstances alluded to, the proportions are less favourable, being one death to every 407 persons employed and 75,153 tons produced.

The following percentages of the total mortality under the different columns from and including the year of my appointment (1867) up to and including 1893 are interesting.

From explosions of firedamp	18·43	per cent.
From falls of roof and sides	44·98	,,
In shafts	9·57	,,
From miscellaneous causes underground	17·19	,,
On the surface	9·83	,,
	100·	

The following table shows the rate of production in the district, per person employed in each year since and including 1880:—

In 1880, 296 tons of mineral raised per person employed.
,, 1881, 309 ,, ,, ,,
,, 1882, 309 ,, ,, ,,
,, 1883, 317 ,, ,, ,,
,, 1884, 308 ,, ,, ,,
,, 1885, 298 ,, ,, ,,
,, 1886, 301 ,, ,, ,,
,, 1887, 307 ,, ,, ,,
,, 1888, 313 ,, ,, ,,
,, 1889, 320½ ,, ,, ,,
,, 1890, 297 ,, ,, ,,
,, 1891, 284 ,, ,, ,,
,, 1892, 273½ ,, ,, ,,
,, 1893, 184⅔ ,, ,, ,,

It must be remembered that the collieries were only at work practically two-thirds of the year in 1893, owing to the unfortunate dispute, and therefore if it be estimated that one-third of the actual output would have been raised in the remaining four months of the year, had the collieries been at work, the production per person employed would have been 246⅓ tons, as compared with the former years in the table.

Summary of separate Fatal Accidents in the Yorkshire and Lincolnshire District during the year ending 31st December 1893.

Explosions of firedamp	2
Falls of roof and sides	35
In shafts	7
Miscellaneous underground	12
On the surface	18
Total	74

SUMMARY of Lives lost in the above Accidents.

Explosions of firedamp	142
Falls of roof and sides	37
In shafts	9
Miscellaneous underground	12
On the surface	18
Total	218

DEATHS from Shaft Accidents.

Whilst ascending or descending by machinery	4
Falling into shaft from surface	1
Falling from part way down	1
Struck by wire rope conductor	1
Fell into sump	1
Crushed by cage	1
Total	9

DEATHS from Miscellaneous Causes Underground.

By explosives	2
Suffocation by gases	1
On inclined and engine planes	3
By trams and tubs	5
Burnt by paraffin	1
Total	12

DEATHS on the Surface.

By machinery	4
Run over or crushed by waggons	6
Run over by locomotive	1
Attempting to jump on to waggons in motion	1
Whilst erecting "3 legs" one fell on to him	1
Strained himself whilst lifting props	1
Fell whilst carrying a rail	1
Fell on shunting pole, which broke whilst he was using it	1
Fell from winding engine platform	1
Fell from a platform. (He was not at work at the time.)	1
Total	18

MONTHLY STATEMENT of DEATHS caused by ACCIDENTS in the MINES of the YORKSHIRE AND LINCOLNSHIRE DISTRICT during the year 1893.

Month.	Explosions of Firedamp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	On the Surface.	Total.
January	—	9	1	1	3	14
February	—	2	—	2	3	7
March	—	5	—	4	1	10
April	—	6	1	2	3	12
May	3	2	1	1	—	7
June	—	4	—	—	2	6
July	139	—	—	—	2	141
August	—	1	3	—	1	5
September	—	1	—	—	—	1
October	—	2	—	1	—	3
November	—	3	—	1	1	5
December	—	2	3	—	2	7
Total	142	37	9	12	18	218

The following TABLE shows the number of DEATHS from VARIOUS CAUSES during the last 26 years in this District.

Nature of Accident.	Deaths.											
	1868.	1869.	1870.	1871.	1872.	1873.	1874.	1875.	1876.	1877.	1878.	1879.
Explosions of firedamp -	6	1	11	10	45	12	30	162	3	3	4	31
Falls of roof and sides -	36	41	46	42	43	52	49	62	37	59	40	41
In shafts - - -	11	7	14	13	14	18	8	11	9	19	5	14
Miscellaneous underground	13	15	14	12	28	15	10	21	8	11	22	17
On the surface - - -	14	5	5	7	3	18	15	11	14	15	10	11
Totals of lives lost -	80	69	90	84	133	115	112	267	71	107	81	114
Totals of accidents -	77	62	83	80	96	105	88	105	71	100	77	77

Nature of Accident.	Deaths.														
	1880.	1881.	1882.	1883.	1884.	1885.	1886.	1887.	1888.	1889.	1890.	1891.	1892.	1893.	Total.
Explosions of firedamp -	11	1	8	20	1	2	23	—	4	2	2	2	1	142	537
Falls of roof and sides -	64	40	57	48	58	46	56	74	53	56	48	42	45	37	1,272
In shafts - - -	6	8	4	6	11	7	17	6	6	6	9	18	5	9	261
Miscellaneous underground	19	17	13	20	18	26	22	23	18	30	29	28	23	12	484
On the surface - - -	6	9	13	15	9	4	13	8	7	12	14	9	9	18	274
Totals of lives lost -	106	75	95	109	97	85	131	111	88	106	102	99	83	218	2,828
Totals of accidents -	95	75	87	89	94	84	100	107	85	101	99	89	76	74	2,276

TABLE showing the Number of Deaths, the Amount of Mineral raised, and the Number of Tons of Mineral raised for each Death during the 22 years ending 31st December 1893.

Year.	Number of Deaths.	Amount of Mineral raised.	Tons of Mineral raised for each Death.
1872 - -	133	14,576,000	109,594
1873 - -	115	15,311,778	133,146
1874 - -	112	15,221,909	135,910
1875 - -	267	16,395,503	61,406
1876 - -	71	15,717,143	221,227
1877 - -	107	16,370,842	152,999
1878 - -	81	16,188,179	199,854
1879 - -	114	16,710,255	146,581
1880 - -	106	17,969,974	169,528
1881 - -	75	18,793,831	250,584
1882 - -	95	19,078,852	200,830
1883 - -	109	20,120,256	184,589
1884 - -	97	19,748,234	203,590
1885 - -	85	18,964,370	223,110
1886 - -	131	19,818,077	151,283
1887 - -	111	20,545,900	185,098
1888 - -	88	20,956,481	238,142
1889 - -	106	22,457,749	211,866
1890 - -	102	22,819,630	223,722
1891 - -	99	23,313,506	234,722
1892 - -	83	23,709,072	285,651
1893 - -	218	16,383,309	75,153

The following TABLE is of interest as showing comparisons between this District and the whole Kingdom.

	1893.	1892.	Increase.	Decrease.
Total number of mines in the kingdom -	3,383	3,403	—	20
Average number of mines for each district -	282	284	—	2
Actual number of mines in Yorkshire and Lincolnshire.	424	416	8	—
Total number of persons employed in mines in the kingdom.	683,008	683,642	—	634
Average number of persons employed in mines in each district.	56,917	56,970	—	53
Actual number of persons employed in mines in Yorkshire and Lincolnshire.	88,699	89,046	—	347
Total amount of mineral produced in the kingdom.	175,236,857	191,954,908	—	16,718,051
Average amount of mineral produced in each district.	14,603,071	15,996,242	—	1,393,171
Actual amount of mineral produced in Yorkshire and Lincolnshire.	16,383,309	23,709,072	—	7,325,763

List of Collieries where Fatal Accidents have

Owner's Name.	Name of Colliery.	Deaths. 1868.	1869.	1870.	1871.	1872.	1873.	1874.
Earl Fitzwilliam	Elsecar Collieries	2	1	1	2	3	2	—
John Brown and Co.	Aldwarke Main	1	—	1	2			
	Car House	2	1	1	3	}3	3	4
	Rotherham Main	—	—	—	—			
T. M. Carter and Co.	Allerton Bywater	2	1	—	—	1	—	—
Farnley Iron Co.	Farnley	3	—	—	—	1	2	—
Newton, Chambers, and Co.	Thorncliffe&Rockingham	1	1	4	4	2	3	2
Cliffe Coal and Fire Clay Co.	Hollingthorpe	1	—	1	—	1	—	—
Lundhill Coal Co.	Lundhill	1	—	2	1	4	1	1
Jeffcock and Dunn	Carbrook	1	1	—	—	—	—	—
J. and J. Charlesworth's Collieries	- - - -	6	2	—	4	2	5	26
Isaac Wood and Son	Dean Lane and Harrop Edge	1	—	—	1	1	—	—
Sturges and Co.	New Gawber Hall	1	1	—	—	—	1	—
R. M. and Holmes Co.	Holmes	3	1	3	3	1	1	1
Thrybergh Hall Co.	Thrybergh Hall	1	—	—	—	—	—	—
B. Huntsman	Tinsley Park	3	4	5	1	—	—	2
Hird, Dawson, and Hardy	Low Moor	2	2	—	1	2	5	3
D. Wroe and Co.	Heckmondwike Waterloo	2	—	—	1	—	—	—
New Sharlston Coal Co.	Sharlston	1	1	—	2	1	2	1
Rothervale Coal Co.	Fence Orgreave Treeton	1	—	2	2	1	1	—
Greenhough and Co.	Adwalton	1	—	—	—	—	—	—
Lord St. Oswald	Nostell	1	—	—	1	—	—	—
Monk Bretton Coal Co.	Monk Bretton	1	—	1	1	1	1	1
J. Haigh	Victoria, Morley	1	—	2	—	—	—	—
Pope and Pearson	West Riding & Silkstone	1	2	1	1	4	4	—
Wombwell Main Co.	Wombwell Main	2	2	3	3	1	—	2
W. Ingham and Sons	Wortley	1	—	—	—	—	—	—
Edmunds and Swaithe Main Co.	Swaithe Main	1	1	1	1			
	Edmund's Main	—	—	1	1	}2	1	3
Mitchell and Co.	Mitchell Main	—	—	—	—	—	—	—
Victoria Coal and Coke Co.	Stanley Park Hill	2	2	—	1	—	2	2
Silkstone Fall Co.	Silkstone Fall	1	1	—	—	—	—	—
T. & R. W. Bower	Allerton	3	—	—	—	3	1	1
Manston Coal Co.	Manston	2	2	—	1	1	1	—
Kiveton Park Coal Co.	Kiveton Park	1	1	—	2	3	1	3
Leather and Littlewood	Ellis Laith	1	—	—	—	—	—	—
Skinner and Holford	Waleswood	1	—	2	2	3	—	1
Bowling Iron Co.	Bowling	2	1	3	—	—	—	1
H. Briggs, Son, and Co.	Whitwood	1	—	2	—	2	6	3
A. Harding and Co.	Beeston Manor	1	1	—	—	1	—	—
J. Jackson	Great Gomersal	1	—	—	—	—	—	—
J. T. Leather	Waterloo Main	1	1	1	—	—	1	1
W. Ackroyd and Bros.	Morley Main	1	—	—	—	36	—	—
G. and J. Haigh	Ravensthorpe Alverthorpe Dewsbury Moor	2	—	1	1	1	1	1
Wharncliffe Silkstone Co.	Wharncliffe Silkstone	1	1	1	—	1	1	1
West Yorkshire Iron and Coal Co.	West Ardsley	1	1	1	1	1	1	2
E. Sutcliffe and Co.	Victoria	1	—	—	—	—	1	—
J. Baistow	Norwood Green	1	—	—	—	—	—	—
Blacker Main Co.	Blacker Main	2	1	2	—	1	—	1
G. Bailey	St. John's	1	—	—	1	—	—	1
Samuel Fox and Co.	Stocksbridge	1	—	—	—	1	—	—
Woolley Coal Co.	Woolley	1	3	2	2	—	4	1
Hoyland Silkstone Coal Co.	Hoyland Silkstone	1	—	—	1	1	—	—
Howley Park Co.	Howley Park	1	—	—	—	—	—	—
Locke and Co.	St. John's Kippax	1	—	3	1	2	—	3
Staveley Coal and Iron Co.	North Staveley	1	—	—	—	1	1	—
Garforth Coal Co.	Garforth	1	1	—	1	—	2	—
Asquith Bros.	Howden Clough	1	—	—	—	1	1	—
W. Day	Mount Osborne	1	2	5	2	4	2	3
J. Rhodes	Woodthorpe	—	1	1	—	—	1	—
G. A. Haworth and Co.	Silkstone Main	—	1	—	—	—	3	1
Norwegian Titanic Co.	Neville Hill	—	1	—	—	—	—	1
C. Cammell and Co.	Oaks	—	2	2	3	1	5	4
R. C. Clarke	Old Silkstone	—	1	—	—	—	—	2

occurred in the Years 1868 to 1893 inclusive.

Deaths.																			
1875.	1876.	1877.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	1887.	1888.	1889.	1890.	1891.	1892.	1893.	Total.
—	2	2	3	1	3	3	2	—	5	1	2	1	2	1	—	2	—	1	42
9	2	—	1	3	2	—	1	2	3	8	2	5	1	3	7	8	2	5	85
—	—	—	—	—	2	1	1	1	—	—	1	—	—	—	1	3	1	—	15
—	—	1	—	—	—	—	1	1	—	—	—	—	1	—	—	—	—	—	10
3	4	2	1	3	5	2	3	3	3	3	4	6	6	4	5	4	6	3	87
—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	4
2	2	2	1	1	1	1	1	—	—	—	1	—	—	—	—	—	—	—	22
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2
3	2	1	5	2	2	1	3	2	2	2	1	2	5	5	3	2	2	4	94
—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	4
—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	4
3	—	5	1	1	—	1	—	—	—	—	—	—	—	—	—	—	—	—	24
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
4	2	2	1	—	2	—	2	—	—	1	—	1	1	1	—	1	2	1	36
1	3	3	2	1	1	2	2	1	1	1	1	3	—	1	1	1	—	2	42
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3
—	2	1	1	2	2	2	1	3	1	1	3	2	1	—	1	1	2	4	38
3	1	3	1	—	—	—	1	1	—	3	2	7	2	1	3	1	3	3	42
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
—	—	—	—	—	—	—	—	—	1	—	2	—	—	—	4	1	1	—	11
—	—	5	1	2	1	2	1	3	2	2	—	3	4	2	1	1	2	3	41
—	—	1	1	1	1	—	8	—	1	—	—	—	—	—	—	1	—	—	17
2	1	—	1	2	—	3	3	1	1	3	24	—	—	—	2	4	1	—	61
—	1	1	—	—	2	2	—	1	—	—	2	1	—	3	—	—	1	2	29
—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	2
146	—	—	1	—	1	2	2	—	2	—	—	1	—	1	1	1	—	—	170
—	—	1	—	—	1	—	—	2	—	2	4	1	3	4	1	1	—	1	21
6	—	5	3	23	4	—	2	2	2	4	3	5	2	1	3	1	2	1	78
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2
—	—	3	—	—	3	1	3	2	3	1	—	3	1	4	2	1	—	—	35
—	1	—	—	1	1	—	—	—	—	—	—	—	—	—	—	—	—	—	10
2	3	—	—	—	5	2	1	1	1	3	2	1	2	4	1	—	—	1	40
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
2	1	—	—	—	2	1	1	—	1	1	4	—	1	1	—	1	1	—	26
5	2	3	2	2	—	—	2	—	—	2	—	3	—	—	2	—	—	—	30
10	1	4	1	5	2	4	2	1	2	3	5	1	1	4	3	1	—	6	70
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
—	—	1	—	—	1	—	—	1	1	1	1	—	3	1	—	—	—	—	15
—	1	—	1	1	—	1	—	2	1	1	1	1	1	1	3	2	—	—	54
2	—	—	2	—	1	1	1	—	1	1	—	—	1	—	1	—	6	1	25
—	2	—	—	1	—	—	—	2	1	2	3	5	3	1	—	—	1	—	27
3	2	—	1	1	—	—	—	1	1	—	2	—	1	1	—	2	—	—	23
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
1	—	2	—	—	—	1	1	—	—	—	1	—	—	—	—	—	—	—	13
—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	4
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	3
—	—	—	2	—	1	—	—	—	1	1	1	1	—	2	—	3	1	—	26
1	—	1	1	1	3	1	2	4	2	1	1	1	—	3	5	—	—	—	30
—	—	—	—	—	—	—	—	—	1	—	1	—	—	—	—	1	—	1	5
2	—	3	—	—	1	1	5	2	2	1	1	—	4	4	—	—	3	—	39
1	—	—	—	1	—	—	—	—	—	—	2	—	—	—	1	2	1	—	11
—	2	—	—	—	1	2	—	—	2	—	—	1	—	—	—	2	—	1	16
—	—	—	1	1	—	—	—	—	—	—	—	1	—	1	—	1	1	—	9
2	1	2	1	—	1	—	2	—	—	—	—	—	—	—	—	—	—	—	28
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3
2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	7
—	—	1	—	—	—	—	—	2	—	—	—	—	—	—	—	—	—	—	5
4	—	2	—	4	4	4	—	1	5	—	—	1	—	3	2	2	—	2	51
1	—	—	—	—	3	—	—	—	—	—	—	—	—	1	—	—	1	—	9

List of Collieries where Fatal Accidents

Owner's Name.	Name of Colliery.	Deaths.						
		1868.	1869.	1870.	1871.	1872.	1873.	1874.
Thorp's Gawber Hall Co.	Thorp's Gawber Hall	—	1	1	1	—	3	1
Darfield Main Co.	Darfield Main	—	3	3	1	2	1	1
Wheldale Coal Co.	Wheldale	—	1	—	2	—	2	2
R. Craik and Co.	East Gawber Hall	—	2	2	1	1	5	3
Seth, Senior, and Sons	Box Ings	—	1	—	—	—	—	—
Lodge, Webster, and Scott	Healey	—	1	—	—	—	—	—
G. Watkinson and Sons	Darton	—	1	—	—	—	—	—
Townend Bros.	Denholm	—	1	—	—	—	—	—
Denaby Main Co.	Denaby Main	—	3	4	2	5	1	2
Rhodes and Dalby	Snydale Sykes Prince of Wales	—	2	4	1	5	—	—
John Holmes	Churwell	—	1	—	—	—	—	—
Manvers Main Co.	Manvers Main	—	2	—	1	1	2	—
Stansfeld and Co.	Flockton	—	2	—	—	—	—	—
Haynes and Co.	Hall Royd	—	1	1	—	—	—	—
Strafford Main Co.	Strafford Main	—	—	1	1	1	—	—
Hargreaves and Naylor	Whinney Moor and Pildacre	—	—	1	—	—	—	—
Chas. Wheatley's Collieries	Bradley Wood, &c.	—	—	1	—	—	—	—
Hepworth Iron Co.	Wood	—	—	1	—	—	—	—
John Cawthera	Four Lane Ends	—	—	2	—	—	—	—
W. Wood & Sons	Foxholes	—	—	2	—	—	—	—
J. Marsland	Providence	—	—	1	—	—	—	—
Messrs. Greaves	White Hill	—	—	1	—	—	—	—
E. Heeley	Lane End	—	—	1	—	—	—	—
Chickenly Heath Co.	Chickenly Heath	—	—	1	—	—	—	—
Cooper, Sellars, and Co.	Roundwood	—	—	1	—	—	—	—
E. Ingham	Thornhill	—	—	1	2	—	1	—
Cooper and Co.	Worsbro' Park Rescwon	—	—	1	—	4	—	—
Sellars and Co.	Greasbro'	—	—	1	—	—	—	—
York Road Coal and Iron Co.	Killingbeck, &c.	—	—	1	2	—	1	1
J. Sheard	Gregory Spring	—	—	1	—	—	—	—
W. Horn	West Scrafton	—	—	1	—	—	—	—
Middleton Coal Co.	Middleton	—	—	—	1	—	—	3
Trustees of H. Ellis	Kirkstyles	—	—	—	1	—	—	—
Marriott Brothers	Mirfield Moor	—	—	—	1	—	—	—
W. Ward	Churwell	—	—	—	1	—	—	—
Featherstone Main Co.	Featherstone Main	—	—	—	2	3	—	—
Crawshaw and Warburton	Savile, &c.	—	—	—	1	—	1	—
High Stile Coal Co.	High Stile	—	—	—	1	—	—	2
Park Coal Co.	Liversedge	—	—	—	1	—	—	1
Hall and Stones	High Royd	—	—	—	1	—	1	—
Johnson and Co.	West Pit	—	—	—	1	—	—	—
G. Chambers and Son	Grange	—	—	—	2	1	—	1
T. A. Mann and Co.	Rockley	—	—	—	1	—	—	—
Nunnery Coal Co.	Nunnery	—	—	—	2	5	7	3
Bedford and Co.	Dean Hall	—	—	—	—	1	—	1
Micklefield Coal Co.	Micklefield	—	—	—	—	1	—	—
Swan Bank Coal Co.	Swan Bank	—	—	—	—	1	—	—
E. J. W. Waterhouse	Chevet	—	—	—	—	1	—	—
Messrs. Harrison	Birkhill	—	—	—	—	1	—	—
Stanley Coal Co.	Liversedge	—	—	—	—	1	1	—
Ellison and Broadbent	Whitwell Main	—	—	—	—	1	—	—
T. H. Thorp	Glass Houghton	—	—	—	—	1	—	—
J. Denton and Co.	Grimesthorpe Brightside	—	2	1	—	1	5	—
Grosvenor and Son	New Hall	—	—	—	—	1	—	—
Waterloo and Woodlesford Co.	Woodlesford	—	—	—	—	—	1	—
J. H. Garbutt	Newton Main	—	—	—	—	—	2	—
T. H. Robinson	Leeds	—	—	—	—	—	1	—
Darley Main Co.	Pindar Oaks	—	—	—	—	—	1	—
J. Helliwell	Deepcar	—	—	—	—	—	1	—
Newhill Coal Co.	Newhill	—	—	—	—	—	1	—
W. Parkin and Sons	Robertown	—	—	—	—	—	1	—
W. Bracewell	Ingleton	—	—	—	—	—	1	1
Silkstone & Dodworth Coal & Iron Co.	Dodworth	—	—	—	—	—	3	—
B. Lockwood	Shuttle Eye	—	—	—	—	—	1	—
W. Lambert	Threshfield	—	—	—	—	—	2	—
J. Critchley	Batley	—	—	—	—	—	1	—
W. H. Stone	Aston Main	—	—	—	—	—	1	—

have taken place—*continued.*

Deaths.																			
1875.	1876.	1877.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	1887.	1888.	1889.	1890.	1891.	1892.	1893.	Total
5	—	—	1	1	1	—	1	1	1	—	—	2	—	3	—	1	1	—	25
4	—	—	—	—	—	1	3	1	—	1	—	3	1	3	3	2	—	—	33
3	3	—	1	1	—	—	2	—	3	1	2	2	—	2	2	5	2	—	36
1	—	3	4	—	3	—	3	22	1	3	6	3	—	2	2	—	—	1	68
—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	2
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
—	1	1	1	2	2	4	1	3	2	1	4	3	2	—	2	—	2	2	50
—	1	1	1	8	—	—	—	1	1	2	2	1	—	1	1	1	1	2	36
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
2	4	3	1	4	4	1	1	2	6	—	1	2	—	6	2	5	4	2	56
1	—	2	1	—	—	2	—	—	—	—	1	—	1	—	—	—	1	—	11
2	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	1	—	—	6
1	2	1	—	1	—	—	3	1	—	1	1	1	1	1	4	1	2	1	25
—	—	—	1	—	—	1	—	1	1	—	—	—	1	—	—	—	—	—	6
—	—	—	1	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	3
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2
—	—	1	—	—	—	2	—	—	—	—	—	—	—	2	2	1	1	—	11
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
—	2	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	3
—	—	2	—	1	1	1	1	1	1	—	—	2	2	—	1	1	1	—	17
—	—	2	—	—	—	—	2	1	2	—	—	1	1	—	—	—	—	139	152
—	2	—	—	2	1	1	1	—	—	—	—	1	—	—	—	1	—	—	14
—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	2	5
1	—	1	—	1	2	—	—	—	—	1	—	—	—	—	—	—	—	—	11
1	—	—	—	—	3	—	—	—	—	—	—	—	—	—	—	—	—	—	5
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
—	—	—	—	—	5	2	—	—	2	—	—	1	—	—	—	—	—	—	14
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
2	—	1	2	—	—	1	—	1	—	—	1	2	2	1	—	1	1	1	21
—	—	—	—	—	1	—	—	1	1	—	1	1	1	—	—	—	1	—	9
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3
1	—	—	2	5	—	1	—	1	—	—	—	—	—	—	—	1	—	—	13
1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
—	—	—	—	—	—	—	—	—	—	—	—	3	—	—	—	—	—	—	7
—	—	—	1	—	—	—	—	—	1	1	—	—	—	—	—	—	—	—	4
1	1	4	1	2	1	2	3	1	5	—	6	1	2	3	6	3	5	4	68
—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	4
—	—	1	1	—	2	—	—	1	—	—	1	—	—	—	—	—	—	—	7
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
—	—	—	—	1	—	—	—	—	—	—	1	—	1	—	1	—	—	—	6
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
2	—	—	1	1	2	—	3	1	1	—	—	1	1	2	1	4	1	3	25
2	—	—	—	2	1	—	—	1	—	—	—	—	—	1	—	—	—	—	16
—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2
—	—	1	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	4
—	1	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	4
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
—	—	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3
—	1	—	2	—	4	—	—	4	1	1	3	1	2	1	2	2	—	—	27
—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	2
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2
—	—	—	—	—	—	2	—	—	—	—	—	—	—	—	—	—	—	—	3
—	—	1	—	—	1	—	—	1	—	—	—	—	—	—	—	—	—	—	4

List of Collieries where Fatal Accidents

Owner's Name.	Name of Colliery.	Deaths. 1868.	1869.	1870.	1871.	1872.	1873.	1874.
Fryston Coal Co.	Fryston	—	—	—	—	—	—	1
John Tordoff	Wibsey Bank Foot	—	—	—	—	—	—	1
Bastow and Crossley	White Lee	—	—	—	—	—	—	1
W. Parkin and Sons	Fall Lane	—	—	—	—	—	—	1
Rhodes, Wright, and Wroe	Park Farm	—	—	—	—	—	—	1
C. Marsden and Sons	Smithies	—	—	—	—	—	—	1
Wharncliffe Woodmoor Coal Co.	Wharncliffe Woodmoor	—	—	—	—	—	—	1
John Crowley and Co.	Wincobank	—	—	—	—	—	—	2
E. Lockwood	Woodwell	—	—	—	—	—	—	1
Airedale Brick and Tube Co.	Shipley	—	—	—	—	—	—	1
E. Brooke & Sons	Stile Common	—	—	—	—	—	—	—
Grayson, Lowood, & Co.	Lowood's Wharncliffe	—	—	—	—	—	—	—
T. C. Taylor & Co.	Gomersal Main	—	—	—	—	—	—	—
J. Haigh & Sons	Snowgate Head	—	—	—	—	—	—	—
J. & W. Woodhead	Manor	—	—	—	—	—	—	—
Crossland Coal Co.	Scholes	—	—	—	—	—	—	—
Mirfield Coal Co.	Mirfield Dark Lane	—	—	—	—	—	—	—
Industrial Coal & Iron Co.	Woodhouse Junction	—	—	—	—	—	—	—
Leathly, Bailey, and Dixon	Andrew Hill	—	—	—	—	—	—	—
Doles and Lumb Wood Co.	Doleswood	—	—	—	—	—	—	—
Guy Senior	Oakwell	—	—	—	—	—	—	—
Lofthouse Coal Co.	Lofthouse	—	—	—	—	—	—	—
Mid-Lincoln Iron Co.	Monks Abbey and Greetwell	—	—	—	—	—	—	—
Corton Wood Coal Co.	Corton Wood	—	—	—	—	—	—	—
D. Micklethwaite and Co.	Wrenthorpe	—	—	—	—	—	—	—
Monckton Main Coal Co.	Monckton Main	—	—	—	—	—	—	—
P. Diggett and Co.	Grange Lane	—	—	—	—	—	—	—
T. Johnson	Newmarket	—	—	—	—	—	—	—
Bell Armitage	Dodworth Road	—	—	—	—	—	—	—
Jos. Blakeley	Soothill Wood	—	—	—	—	—	—	—
Yorks. & Derbyshire Coal & Iron Co.	Carlton Main	—	—	—	—	—	—	—
J. Simpkin	Joan Royd	—	—	—	—	—	—	—
Messrs. Jaggar	Emley Moor	—	—	—	—	—	—	—
C. and H. Tinker	Wood	—	—	—	—	—	—	—
Walker and Reddick	Sykes	—	—	—	—	—	—	—
Terry, Greaves, and Co.	Roundwood	—	—	—	—	—	—	—
Dymond and Co.	Liversedge	—	—	—	—	—	—	—
South Kirkby Coal Co.	South Kirkby	—	—	—	—	—	—	—
R. Holliday and Sons	East Ardsley	—	—	—	—	—	—	—
Holmes and Stocks	Quarry House	—	—	—	—	—	—	—
Ibbotson and Haigh	Dungworth	—	—	—	—	—	—	—
G. Fountain and Son	Haigh	—	—	—	—	—	—	—
Fitzwilliam Hemsworth Co.	Fitzwilliam Hemsworth	—	—	—	—	—	—	—
J. Hinchcliffe	Bullhouse	—	—	—	—	—	—	—
Miss E. L. Kaye	Denby Grange	—	—	—	—	—	—	—
H. Lodge	Ryhill Main	—	—	—	—	—	—	—
Wilcock and Co.	Rock	—	—	—	—	—	—	—
Newmarket Coal Co.	Newmarket	—	—	—	—	—	—	—
S. Brown	Flockton	—	—	—	—	—	—	—
Hodroyd Coal Co.	Hodroyd	—	—	—	—	—	—	—
Holdsworth and Wilkinson	Beckitt Street	—	—	—	—	—	—	—
Wath Main Co.	Wath Main	—	—	—	—	—	—	—
J. Gooddy	Darfield Clay Mine	—	—	—	—	—	—	—
Barrow Hæmatite Steel Co.	Barrow	—	—	—	—	—	—	—
T. S. Walsh	Dam Head	—	—	—	—	—	—	—
Houghton Main Co.	Houghton Main	—	—	—	—	—	—	—
Luty and Armitage	New Hall	—	—	—	—	—	—	—
Lord Masham	Ackton Hall	—	—	—	—	—	—	—
John Lister	Sunny Bank	—	—	—	—	—	—	—
Joe Kitson	Denby Dale	—	—	—	—	—	—	—
Clayton and Speight	Ravels	—	—	—	—	—	—	—
Flockton Coal Co.	Hartley Bank	—	—	—	—	—	—	—
T. Woollen	Woodhouse Lane	—	—	—	—	—	—	—
Lidgett Coal Co.	Lidgett	—	—	—	—	—	—	—
J. Lewis	Crossing Lane	—	—	—	—	—	—	—
Jos. Haigh	Sinking Wood	—	—	—	—	—	—	—
Jos. Bedford	Falhouse	—	—	—	—	—	—	—
Mangham and Co.	Scholes	—	—	—	—	—	—	—
Fearnley Garforth	Spring Gardens	—	—	—	—	—	—	—
Waterhouse and Son	Calder Clay Mine	—	—	—	—	—	—	—
W. and J. Cardwell	Whitley Clough	—	—	—	—	—	—	—

ave taken place—*continued.*

Deaths.

1875.	1876.	1877.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	1887.	1888.	1889.	1890.	1891.	1892.	1893.	Total.
1	—	—	—	1	1	—	—	3	—	1	—	3	2	5	1	—	—	—	19
—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
—	—	1	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	3
—	—	—	1	—	—	—	—	1	—	—	—	—	1	—	—	—	—	—	4
—	—	—	—	—	1	—	—	—	1	—	—	—	—	—	—	—	—	—	3
—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	2
1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	2
2	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	3
1	—	—	1	—	—	—	1	—	—	1	—	—	—	—	—	—	—	—	4
4	—	—	1	—	—	—	—	—	3	2	—	1	—	1	1	—	1	—	14
2	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3
1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
1	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2
—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
—	2	3	—	1	1	1	1	—	1	1	3	1	2	1	1	1	—	—	20
—	1	—	—	—	1	—	—	1	—	1	—	—	—	1	—	—	1	—	6
—	1	3	—	—	1	—	4	1	2	2	—	2	—	2	—	3	1	1	23
—	1	—	—	—	—	1	—	1	—	—	—	—	—	—	—	—	—	—	3
—	2	2	—	1	4	—	2	—	—	3	2	5	—	—	2	1	—	1	25
—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
—	1	—	—	—	—	—	—	—	—	—	—	—	2	—	—	—	1	—	4
—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
—	—	1	—	1	—	2	—	—	—	—	—	—	—	2	—	—	1	—	7
—	—	1	—	3	1	—	—	1	1	—	2	1	2	1	4	1	2	1	21
—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
—	—	1	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	2
—	—	1	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	1	3
—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
—	—	1	—	1	—	—	2	—	—	1	—	—	2	—	—	—	—	1	8
—	—	1	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2
—	—	4	—	—	—	—	2	—	2	2	1	—	1	1	1	1	—	—	15
—	—	1	—	—	—	—	—	—	—	2	1	1	2	—	1	—	—	2	10
—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	2
—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
—	—	—	1	—	—	—	—	—	—	1	—	—	1	—	—	—	—	—	3
—	—	—	1	5	1	—	—	3	1	—	—	1	—	—	2	—	1	—	15
—	—	—	1	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2
—	—	—	1	—	—	—	—	1	—	2	—	1	—	—	—	1	—	—	6
—	—	—	1	—	—	2	—	—	2	1	—	—	—	—	—	2	—	—	8
—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
—	—	—	3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3
—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
—	—	—	—	1	—	1	—	—	1	—	—	2	—	—	1	1	1	—	8
—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
—	—	—	—	1	—	1	1	3	1	—	1	2	2	1	1	—	2	2	18
—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
—	—	—	—	—	1	1	—	—	1	2	10	1	4	2	—	—	3	1	26
—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	1
—	—	—	—	—	—	1	1	1	—	1	—	—	—	—	—	—	1	1	6
—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	1	2
—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	1
—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	1
—	—	—	—	—	—	—	—	1	1	—	—	—	—	—	—	—	—	1	3
—	—	—	—	—	—	—	—	1	—	—	—	—	1	—	—	—	—	—	2
—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	1	1	—	3
—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	1
—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	1
—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	1
—	—	—	—	—	—	—	—	—	—	—	—	2	—	—	—	—	—	—	2
—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	1
—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	1
—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	1

List of Collieries where Fatal Accidents

Owner's Name.	Name of Colliery.	Deaths.						
		1868.	1869.	1870.	1871.	1872.	1873.	1874.
Crigglestone Coal Co.	Woollen Well Main	—	—	—	—	—	—	—
Low Laiths Coal Co.	Low Laiths	—	—	—	—	—	—	—
James Hall	Thorncliffe Green	—	—	—	—	—	—	—
D. Rylands	Rylands Main	—	—	—	—	—	—	—
Kippax Lime Co.	Medhurst	—	—	—	—	—	—	—
Newton Brooke	Shibden Hall	—	—	—	—	—	—	—
W. Woodhead and Son	Dixon	—	—	—	—	—	—	—
Briggs and Sons	Queensbury	—	—	—	—	—	—	—
T. Thresh and Son	Westgate Common	—	—	—	—	—	—	—
	Total	80	69	90	84	133	115	112

ve taken place—*continued.*

Deaths.																			
875.	1876.	1877.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	1887.	1888.	1889.	1890.	1891.	1892.	1893.	Total.
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	1	2
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	—	—	—	2
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	1	—	3
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1	2
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	1
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	1
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	2
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1
:67	71	107	81	114	106	75	95	109	97	85	131	111	88	106	102	99	83	218	2,828

The following tables show the comparative percentages between this district and the United Kingdom as regards the various causes of deaths from accidents :—

1893.

YORKSHIRE AND LINCOLNSHIRE.

Explosions of firedamp	65·13
Falls of roof and sides	16·99
In shafts	4·12
Miscellaneous underground	5·51
On the surface	8·25
	100·

1893.

GREAT BRITAIN AND IRELAND.

Explosions of firedamp	15·09
Falls of roof and sides	38·87
In shafts	9·72
Miscellaneous underground	25·
On the surface	11·32
	100·

LIST of NON-FATAL ACCIDENTS in the YORKSHIRE and LINCOLNSHIRE DISTRICT from EXPLOSION of FIREDAMP UNDERGROUND in MINES during the Year 1893.

Date.		No. of Acci-dent.	Name of Colliery.	Where situate.	Owner of Colliery.	No. of Persons injured.	Occupation.
Feb.	27	1	Hall Royd	Barnsley	I. Haynes	1	Dayman.
Mar.	11	2	Primrose Main	"	Primrose Main Coal Co.	1	Deputy.
April	15	3	Newmarket	Wakefield	I. and J. Charlesworth	1	Collier.
"	15	4	Stocksbridge	Sheffield	S. Fox & Co.	1	"
June	5	5	Bullhouse	Pemstone	J. Hinchliffe	1	"
Aug.	4	6	Elland	Elland	J. Sharratt & Son	2	Manager and collier.
"	13	7	Nunnery	Sheffield	Nunnery Coal Co.	2	Sinkers.
Oct.	20	8	Grimesthorpe	"	T. Denton & Co.	1	Collier.
"	25	9	Six Lane Ends	Wakefield	Middleton Coal Co.	3	Colliers and hurrier.
Nov.	28	10	Lodge Mill	Huddersfield	B. Elliott.	1	Collier.
Dec.	13	11	Old Silkstone	Barnsley	R. C. Clarke.	1	"

In referring to the constitution of the Board of Examination for Managers' Certificates, and its work during the year, I have to state that the Secretary of State was pleased to appoint the Right Honourable Lord St. Oswald as a member, in succession to his father.

It is with feelings of much sorrow I have to report that during the past year the deaths occurred of Mr. B. Huntsman, and Mr. T. W. Embleton. Both these gentlemen had been members of the Board since its first appointment in 1872. They had devoted much time, and never spared themselves any trouble, in connexion with their duties, and were most regular in attending the meetings of the Board. Each of their colleagues, and, indeed, the district, will feel their loss most deeply. Mr. Embleton was also one of the examiners, a post he had held from the first, and his very long experience and well-known ability enabled him to fulfil his responsible duties to the entire satisfaction, I believe, of all concerned.

The vacancies have not, at the time of writing this Report, been filled up, and the Board consists at present of the following members :—

Lord St. Oswald W. Ackroyd, Esq.	Colliery owners.
T. Carrington, Esq. W. Evans, Esq.	Mining engineers or managers.
Mr. Broadbead Mr. Dixon Mr. Walker	Persons not being owners, &c.

Frank N. Wardell, Esq., H.M. Inspector of Mines.

The Secretary, John R. Jeffery, Esq., whose address is 5, Piccadilly, Bradford, continues to discharge his important duties with the same zeal and efficiency which he has always displayed since his appointment to the office in 1872.

The examination in 1893 was held at the Town Hall, Leeds, on the 20th, 21st, 22nd, and 23rd of June.

There were 34 candidates in the first class, and 24 of these obtained the number of marks entitling them to certificates.

The maximum number of marks obtainable was 900, and the candidate highest in order of merit gained 775.

In the second class, the number of candidates was 84, 46 of whom succeeded in passing.

The candidate highest in order of merit in this class obtained 490 marks out a possible 600.

The following table shows the number of candidates who have been examined in this district, together with the number of those who were successful and obtained certificates from the commencement of the Act in 1872 to the present time:—

Date of Examination.	Total Number of Candidates examined.	Number of Candidates passed.	Number of Candidates examined 1st class, 1887 Act.	Number of Candidates passed 1st class, 1887 Act.	Number of Candidates examined 2nd class, 1887 Act.	Number of Candidates passed 2nd class, 1887 Act.
June 17 and 18, 1873 - -	16	9	—	—	—	—
December 17 and 18, " - -	18	11	—	—	—	—
July 7 and 8, 1874 - -	20	12	—	—	—	—
December 22 and 23, " - -	16	8	—	—	—	—
June 22 and 23, 1875 - -	20	8	—	—	—	—
" 27 and 28, 1876 - -	18	12	—	—	—	—
" 26 and 27, 1877 - -	15	9	—	—	—	—
" 25 and 26, 1878 - -	15	9	—	—	—	—
" 24 and 25, 1879 - -	16	8	—	—	—	—
" 29 and 30, 1880 - -	10	6	—	—	—	—
" 28 and 29, 1881 - -	11	7	—	—	—	—
" 13 and 14, 1882 - -	13	5	—	—	—	—
" 12 and 13, 1883 - -	13	7	—	—	—	—
" 26 and 27, 1884 - -	12	8	—	—	—	—
" 29 and 30, 1885 - -	14	10	—	—	—	—
" 23 and 24, 1886 - -	19	11	—	—	—	—
" 2 and 3, 1887 - -	17	9	—	—	—	—
" 5 and 6, 1888 - -	63	36	9	7	54	29
" 5, 6, and 7, 1889 -	80	60	14	12	66	48
" 23, 24, and 25, 1890 -	89	71	21	16	68	55
" 17, 18, and 19, 1891 -	95	55	24	20	71	35
" 21, 22, 23, and 24, 1892 -	128	67	40	27	88	40
" 20, 21, 22, and 23, 1893 -	118	70	34	24	84	46
Total -	836	508	142	106	431	253

It is unncessary for me in this Report to reiterate remarks made formerly on the beneficial results accruing from the operation of the Mines Acts, and the system of inspection. Increased experience only confirms my views thereon, and they are borne out by statistics.

The work connected with the position I hold continues to be most responsible and important, and is ever increasing. It has received my constant and careful attention during the year.

Over and above a large number of both fatal and non-fatal accidents, which I have investigated, I have made frequent visits to mines promiscuously. In all cases where accidents have occurred it has been my endeavour to give such advice and make such recommendations as seemed most likely to prevent their recurrence. Promiscuous visits, always made without notification, are most valuable in order to ascertain whether there is a compliance with the requirements of the Act generally, on the part of manager and workmen.

Every complaint which is received has been immediately attended to, and has been investigated by myself or my assistants. Anonymous complaints receive an equal share of attention with those where the complainant signs his name, and I most emphatically repeat that where this is done the letter is treated with the strictest confidence, and in no case is the name divulged.

I have likewise attended a large number of inquests, have been engaged at various meetings at the Home Office, at the meetings of the Board of Examination for managers certificates, and was present at the examination itself.

I have taken part in meetings in my district, and outside it, where experiments with safety lamps were being conducted.

I have advised generally, and held consultations as to matters pertaining to safe working, and the requirements of the Acts.

I have dealt with the entire correspondence, which is very extensive and varied, and occupies a considerable portion of my time.

Further, I have attended to such special matters as have been referred to me by the Secretary of State.

There have been 517 underground visits to collieries for special and general purposes made by my assistants and myself.

In the discharge of my duties I have travelled during the year over 15,600 miles.

In addition to the above work, you were pleased to honour me with an appointment on the Commission to enquire into the condition under which quarrying is conducted, with the object of diminishing any proved dangers to the life or health of the workpeople engaged therein.

This enquiry occupied altogether 50 days, and in obtaining the necessary information I travelled over 5,000 miles. The Report of the Committee, of which I had the honour to be chairman, has been now submitted to you.

I have been ably seconded in the work of my district by the efforts of my assistants, Mr. Mellors and Mr. Wilson, who continue to observe and carry out my instructions in a satisfactory manner.

I append a synopsis of the work done by each.

Mr. Mellors made during the year 288 visits of inspection to collieries; of these 87 were promiscuous visits for general purposes. The remainder included inquiry into fatal and non-fatal accidents, and investigations into complaints. He likewise attended a large number of inquests.

In the discharge of his duties he travelled nearly 11,000 miles.

Mr. Wilson made 258 visits to collieries promiscuously, and investigated a large number of fatal and non-fatal accidents. He also enquired into several complaints, and travelled in the performance of his duties more than 13,000 miles.

I append, as I have always done in my reports, certain details connected with some of the accidents which have occurred during the year.

On the 4th July a terrible disaster occurred at the Combs Pit, near Dewsbury, the property of Mr. E. T. Ingham, and it is my painful duty to record that it resulted in the loss of 139 lives. No accident attended with such fearful consequences had taken place in this district since the year 1875, when 143 persons were killed at Swaithe Main Colliery. The accident at Combs Pit forcibly and sternly dispelled the hope which was existing, that disasters of such magnitude had, owing to increasing care and extended scientific appliances, ceased to happen.

You were pleased to direct my colleague, Mr. Hall, to assist me in elucidating the cause of the accident, and, further, Mr. A. Young, barrister-at-law, received your instructions to attend the inquest.

I have already, in conjunction with Mr. Hall, according to your instructions, made a special report to you on this accident, and I consider it advisable to embody it in this Annual Report, together with that of the counsel, recording the result of the inquest, after a very complete and patient investigation by the jury and all concerned.

THORNHILL COLLIERY EXPLOSION INQUEST.

SIR, 11, Old Square, Lincoln's Inn, July 31st, 1893.

I BEG to report that, acting upon instructions received from the Solicitor of the Treasury, I attended at the adjourned inquest on the 11th July last, and was present throughout the proceedings. My instructions were to take part in the examination and cross-examination of witnesses, to argue any question which might arise in which I might think that the interests of justice required my interference, and on the conclusion of the inquest to send a report to you containing a short narrative of the case, and, in addition to such other observations as I might think fit to offer, specifying whether in my opinion a prosecution should be instituted against any person and, if so, on what ground.

The enquiry was held at the Local Board Offices, Thornhill, on the 11th and 12th July last, and on the latter day the jury delivered the following verdict :—" We find that James

" Scargill and the 138 other persons whose bodies we have viewed were accidentally killed
" as the result of an explosion in Comb's pit on the 4th July 1893. The jury desire further
" to record their opinion that great praise is due to the gentlemen who formed the rescue
" parties for their action in this matter. They are also of opinion that this pit ought not to
" be worked in future with naked lights at the bottom of the shaft."

The above finding of the jury as to the cause of death merely restated a fact which was universally known, and gives no information as to the cause of the explosion.

The Combs pit is worked by means of a downcast shaft called on the plan sent herewith the "Drawing pit" which is driven through the "New Hards" seam and the "Wheatley" seam to a bed of coal known as the "Blocking bed"; the distance from the surface to the "New Hards" is about 115 yards, from the "New Hards" to the "Wheatley" 25 yards, and from the "Wheatley" to the "Blocking bed" 25 yards. There is also another pit known as the "Water pit" (*vide* plan), which is driven from the surface to the "New Hards" seam. From the "New Hards" a short distance from the bottom of the Water pit there is a shaft known as the "Staple pit," driven through the "Wheatley" seam to the "Blocking bed." The only seam in course of working during the last few years has been the "Wheatley" seam, and it was in that seam that the explosion took place resulting in the loss of 139 lives. The Drawing pit, or downcast shaft, was partially closed 140 yards from the surface by a stage or landing at the bottom of the "Wheatley" seam, but at each side of this landing there was a space of about 4 square feet left open through which air went down to the "Blocking bed." At the landing in question most of the air was sent into the "Wheatley" workings, but the split or current does not appear ever to have been measured. The air which goes past the landing at the bottom of the "Wheatley" seam went down to the "Blocking bed" and returned up the "Staple" pit to the "Wheatley" seam, where it joined the return air which had gone into the "Wheatley" workings at the landing in the downcast shaft, and the whole return air was drawn to the surface by means of a fan at the top of a pit known and shown on the plan as the "Ingham" pit, which was used as an up-cast shaft for the "Combs" pit.

At the time of the explosion the "Combs pit" was being worked in a single shift, the men descending at 6 a.m. and returning to the surface at 2 p.m. each day. The explosion took place a few minutes after midday on the 4th July, midday being the men's dinner hour. The men employed in the "Comb's pit" used safety lamps, but there were five or six naked paraffin lamps during each shift burning in the porches leading into the "Wheatley" workings. Naked lights were also used at the various lamp stations in the pit.

The amount of gas ignited must have been very inconsiderable, as there were no signs of fire or force except in immediate proximity to the point of ignition, namely, the landing in the downcast shaft at the "Wheatley" seam. There was an unanimity of opinion that the gas, wherever it came from, was ignited by one of the naked lights hanging at the landing in the "Wheatley" seam in the downcast shaft, and I have no doubt whatever that that opinion was correct. The downcast shaft was driven through a fault, any gas from which would, if not prevented, issue just under the landing in the downcast shaft at the "Wheatley" seam. That gas from this fault did issue was well known, and the former manager, Jesse Taylor, who was called as a witness, tried to utilise the gas by the insertion of a pipe for the purpose of lighting the porches leading to the Wheatley seam in the downcast shaft. Some 12 months prior to the explosion masons were called in for the purpose of making apertures through the brick lining of the downcast shaft just under the landing in the downcast shaft at the Wheatley seam. The masons worked with naked lights, and it was proved that gas was actually ignited by one of the naked lights at the place in question, though without any evil results. It was also proved that about Easter this year (the date could not be more exactly proved by any witness) gas was found issuing from the said fault, and in consequence of such finding safety lamps were for one day, and for one day only, substituted for the naked lights at the bottom of the downcast shaft in the Wheatley seam. On the 4th May this year the late manager, Jesse Taylor, retired, and the present manager, William Scott, took his place. On the evidence given, Scott did not know of the existence of the fault in question, or of the fact that gas was occasionally given off from it, at or under the landing in the downcast shaft at the Wheatley seam. That the explosion, small as in my opinion it was, was caused by gas given off from the fault coming when intermixed with air into contact with a naked light hanging at the porch at the bottom of the downcast shaft in the Wheatley seam, was abundantly proved.

The explosion unfortunately ignited some wood, namely, the landing or staging before referred to and the conductors from the Wheatley seam to the Blocking bed 25 yards below, and there was certainly a considerable conflagration going on for some hours in the downcast shaft between the Wheatley seam and the Blocking bed.

In my opinion every one of the 139 lives lost was lost by reason of suffocation arising from smoke coupled with a certain amount of afterdamp. I do not think a single life was lost by reason of fire or force.

Nine men were got out of the pit alive late on the evening of the day after the explosion, or nearly 36 hours after its occurrence. Three of these men had died prior to the inquest, and one only of the actual survivors was well enough to be called as a witness, namely, Joseph Mallinson. His evidence, which will be found at page 99 of the shorthand writers' notes of the proceedings on the 12th July, was to the effect that he and about 10 or 11 other men worked on the 4th July in Smith's ending up to 2 p.m., the usual hour for ceasing work, and nearly two hours after the explosion, without having heard any noise and without knowing that anything had happened. On making for the pit so as to reach the surface they met with "a white mist," which eventually extinguished their lights. All these men seem to have returned into Smith's ending, and six of them were brought out alive more than 30 hours after the explosion. Mallinson says he never lost conciousness, but "amused" himself by riding backwards and forwards on his tram until he was rescued. Ten dead bodies were found in Smith's ending, which would seem to show that Mallinson rather understated the number of men who worked on after the explosion without knowing that anything was wrong.

The Combs pit was a wet pit, and there can be no doubt that the absence of coal dust tended to lessen the extent of the explosion.

In my opinion no grounds were disclosed for instituting a prosecution against anyone.

I may, however, add that in my opinion as long as the law allows naked lights to be used, even in the main intake of a pit in which gas is known to be even occasionally given off, so long will there be a possibility and the probability of the occurrence of similar disasters.

I acted throughout in concert with Mr. Frank N. Wardell and Mr. Henry Hall, two of Her Majesty's Inspectors of Mines, from whom I obtained every possible assistance.

I am, &c.
(Signed) A. Young.

To the Right Hon. H. H. Asquith, Q.C., M.P.,
Her Majesty's Principal Secretary of State
for the Home Department.

Sir, Wath-on-Dearne, 8th August 1893.

We have the honour to report to you on the circumstances connected with an explosion of gas which took place at Combs Pit, near Dewsbury, on the 4th July, and which resulted in the loss of 139 lives.

This pit forms a part of what is known as Thornhill Colliery, and is the property of Mr. E. T. Ingham, who lives at Blake Hall, near Mirfield.

The official staff at this colliery consisted of the resident certificated manager, Mr. William Scott, an under manager, Amos Hawksworth, and, in the day shift, two deputies, one for each side of the pit.

Mr. Scott had only been in charge a few weeks, having obtained the appointment in consequence of the former manager's retirement, after a long term of years, owing to his being physically unable to discharge his duties.

The total number of persons at work in the pit on the day of the explosion was 146, including the under manager and two deputies; 57 of this number were boys.

Originally two shafts were sunk at this colliery to the "New Hards" seam of coal, a depth of 115 yards from the surface.

Later, the downcast shaft was sunk to the Blocking bed, a further depth of 50 yards, and a staple pit was sunk to the same seam from the "New Hards." Both these shafts intersected the Wheatley seam about midway between the New Hards and Blocking bed, or about 25 yards below the one and above the other.

Upon the abandonment of the New Hards, the Wheatley seam became the only one in which work was carried on, and it was here where the explosion took place.

The downcast shaft was 11 feet in diameter, and the upcast, known as the "Ingham" pit, 13 feet. According to the latest recorded measurement there were 19,600 cubic feet of air per minute passing through the Wheatley workings, and there would probably be about 2,000 cubic feet passing through the sides of the staging in the downcast shaft, into the Blocking bed.

Ventilation was produced by means of a Guibal fan (30 feet) at the top of the Ingham pit, and which was running at a speed of 48 revolutions per minute.

There was a water guage of 1·70 inches.

Without attributing in any way meteorological conditions as being connected with the explosion, it may be mentioned that on the previous day the locality was visited with one of the most violent thunderstorms ever experienced there.

The seam is not considered a fiery one, and instances of gas being found were comparatively rare. No fatal explosion has occurred in this pit before.

The colliers, however, all used safety lamps—the "Marsaut"—other workpeople having the "Stephenson." Open lights were allowed on the main roads to points about 600 yards from the shaft on the south side, and about 660 yards on the north.

Oil lamps were hung in the porches of the downcast shaft, at the Wheatley seam, three in each porch, at distances varying from 3 to 16 yards from the shaft.

The mode of working this seam is that known as "stoop and room," and will be understood on referring to the plan accompanying this report,

The seam is wet, and there is no part of the workings or roads which can, in the smallest degree, be called dusty.

We made a careful examination of the shafts and workings, accompanied by the manager, and Mr. Garforth and Mr. Nevin, mining engineers, together with Mr. Cowey and Mr. Murray, representing the Miners' Association. In consequence of the Blocking seam having been flooded, it was necessary to wait until the withdrawal of the water before the seam could be entered. Our examination was therefore divided into two parts, the first being confined to the Wheatley seam and the shafts thereto, and the second including the Blocking seam and the shafts between that seam and the Wheatley.

Owing to the fact that the damage done to the shafts and workings was confined within such narrow limits, we were enabled to make an examination as soon as all the bodies had been recovered, and there was not the delay which generally is necessary after terrible disasters such as this, consequent upon fire or heavy falls.

No evidence of the effects of the explosion was to be seen outside a comparatively small radius of the downcast shaft bottom; but, notwithstanding this, we thoroughly examined the pit far beyond these points.

The stables on the south side are only a very short distance from the shaft, but exhibit no trace whatever of burning.

The door of the under manager's cabin, which is a few yards from the shaft, was found closed after the explosion, the paint on the outside of the door being blistered by the heat. Within the cabin were three bodies, but otherwise nothing was disturbed, an oil lamp against the wall hanging in its usual place, and having its glass intact.

Proceeding towards the "north straight ending," a door on the east side was blown a few feet "inbye," although this was only a short distance from the bottom of the shaft. At the junction two oil lamps, in a direct line from the shaft, were standing upright, and with the glass chimnies unbroken.

Just beyond this point, two doors to the west of the "straight ending" were blown down, "inbye," the first being merely turned over, and the second carried a distance of 12 feet from its original position. The reason why this was blown further than the other may have been owing to the fact that the foot of each post was rotten, and no great force would, therefore, be required to displace the door.

A few yards further, another door in the "straight ending" was disturbed—this had not been in use, but was propped open, and the force of the explosion appeared to have struck it on the end. The head-piece of the door frame was blown 3 or 4 yards "inbye," and was much decayed and broken at the end bolt.

We examined the "straight ending" to the "face," but between there and the door last alluded to, no further evidence of the explosion existed.

We next examined the Glebe bord as far as "Ashtons" ending, passing the "Swilly" and "Smiths" endings. A back bord runs parallel with this, and the brick stoppings, 4½ inches thick, in the slits between the two, were perfectly good, and exhibited no trace of the force of the explosion.

A safety lamp, we believe the under manager's, and an oil lamp were found on a water tub near the shaft in an upright position and uninjured.

Some dry spun yarn projecting from a cupboard a few yards from the shaft exhibited no trace of fire, or even heat, although the cupboard door was open.

A few sacks and a quantity of loose hay which were near were quite uninjured, and beyond this point on the south side, which was next examined, there was absolutely no indication whatever of flame having travelled, nor of any heat.

All the way along to the bottom of "Ashtons" ending, lamps were standing erect as though they had simply become extinguished from lack of oil.

The roadways throughout the whole of the mine have suffered comparatively no injury—there are no falls of roof—and had it not been for the lamentable facts which were known,

we would have thought, had we been making an ordinary examination, that work was simply suspended for the dinner hour.

It was at and about the bottom of the shaft itself where the evidences of explosion were more apparent.

Neither the shaft from the Wheatley seam to the surface, nor the wooden conductors nor the cages were injured at all, but the landing stage at the bottom, together with the flat sheets on both sides of the shaft were upheaved.

Workmen's clothing hanging on either side of the porch, as well as some of the props, were badly burnt, in some cases only shreds of the clothing being left.

Corves throughout the pit were standing on the rails, with the exception of some empty ones not far from the shaft, and which were turned over.

The under manager, followed by the hanger-on, had gone, after the explosion, through a door which was kept locked, and of which he had the key, and then through a sheet, expecting, no doubt, to get into the air from the Staple pit, but instead they met the smoke and afterdamp, and their bodies were found about 50 yards beyond the sheet.

The downcast shaft had been sunk some years ago to the Blocking seam, a distance of 25 yards below the Wheatley seam, and a staple pit was also sunk from the New Hards to the Blocking. A heading was driven in this seam, until a "throw" was met with, and on going through this, and boring upwards, it was found that the New Hards was thrown down 48 yards. An incline was then driven from the bottom of the downcast for the purpose of working the New Hards. This seam was finally abandoned in 1888, and as the coal dipped from a point a short distance beyond the "throw," water was allowed to rise, and the whole of the workings became flooded to this point. The only roads left open were those between the downcast and the Staple pit, as shown on the plan, and a pump was fixed at the bottom of the Staple pit to keep these clear from such water as overflowed down the incline. A man went down every day to see that this pump was in good order, and on the morning of the explosion he found no gas, everything appearing to be as usual.

We made a careful examination both of the downcast and staple shafts to the Blocking seam, as well as of such portion of the roads in this seam as were open.

There were no indications whatever of fire, nor any trace of the force of the explosion, in the Blocking seam roads, nor in, nor at the bottom of, the Staple pit, but the downcast shaft between the Wheatley and Blocking seams presented a very different appearance, the wooden cage guides, or conductors, were almost entirely burnt out. Without doubt there had been here a very serious conflagration, and it can be quite understood the exploring party correctly described the noise they heard to be like the roaring of a furnace.

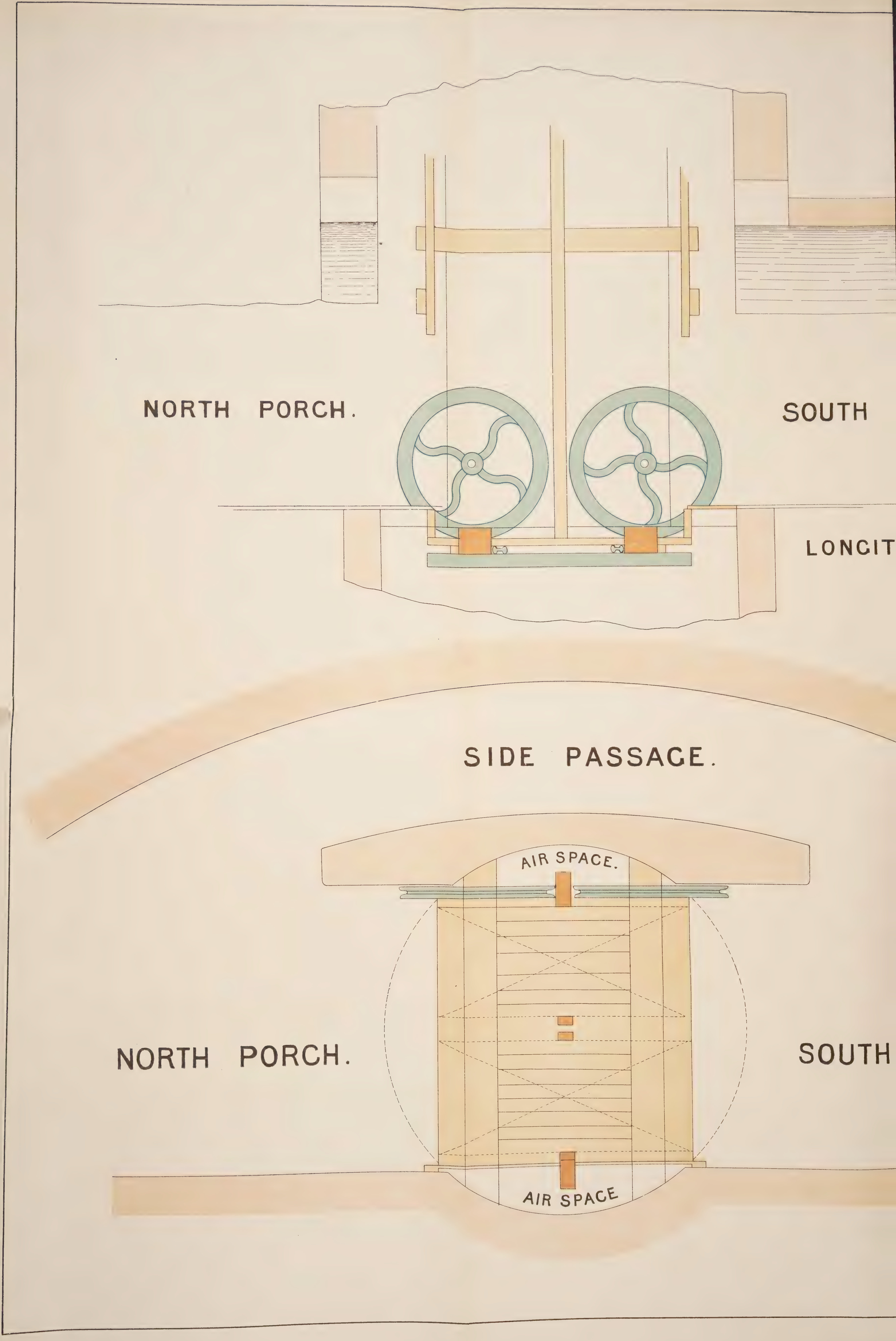
The explosion was caused, in our opinion, by the ignition of an inconsiderable accumulation of gas at the porch of the Wheatley seam in the downcast shaft.

This gas apparently had been given off from a feeder behind the brick walling of the shaft, and collected under and about the scaffold, some of it also finding its way into the troughs or boxes which conveyed the haulage rope under the flat sheets.

A wooden staging was fixed in the shaft at the Wheatley seam for landing the cages, at either side of which was left a space for a scale of air to pass through for the purpose of ventilating the short distance of roads open in the Blocking seam which we have alluded to. These spaces amounted to about 4 square feet in area each, and acted as a regulator, the air passing thus to the bottom, and after traversing the Blocking seam ascending the staple pit, at the top of which it joined the Wheatley seam air, and passed thence to the upcast or "Ingham" pit.

Some time ago when the haulage rope boxes were put in, just under the staging referred to above, a small quantity of gas was given off, and which apparently came from a "leader" or "fault" situate there, and which crossed the shaft in the porch. The manager at that time intended to utilise this gas for lighting the bottom of the shaft, and with this object fixed a pipe having one end through the brick walling in the shaft, the other end being taken up into the porch. This was never used, in consequence of there not being sufficient gas to light. It seems, however, that gas had been noticed here on at least two or three occasions, the most recent being sometime about last Easter, when, in consequence of water rising in the staple pit the airway down the shaft underneath the staging became cut off. The open lights in the porch were at once withdrawn, and safety lamps temporarily substituted. As soon as the blocked airway was restored, open lights, however, were again introduced.

It seemed likely from appearances, after a minute examination, that the gas was ignited at these open lights, and the flame passed like a train of gunpowder to the feeder of gas, described above, under the staging.

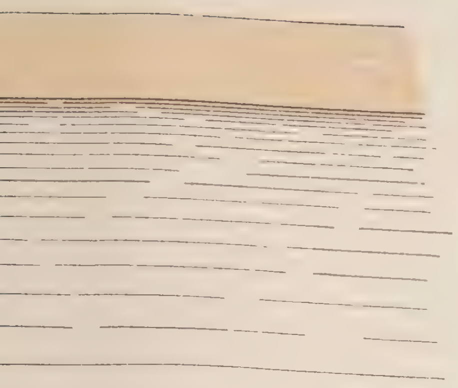

NORTH PORCH.
SOUTH
LONGIT
SIDE PASSAGE.
AIR SPACE.
NORTH PORCH.
SOUTH
AIR SPACE

COMBS PIT

WHEATLEY SEAM.

PLAN AND SECTIONS OF LANDING

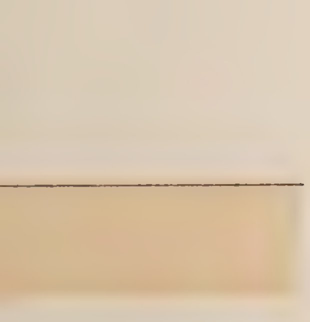
Scale ½ inch = one Foot.

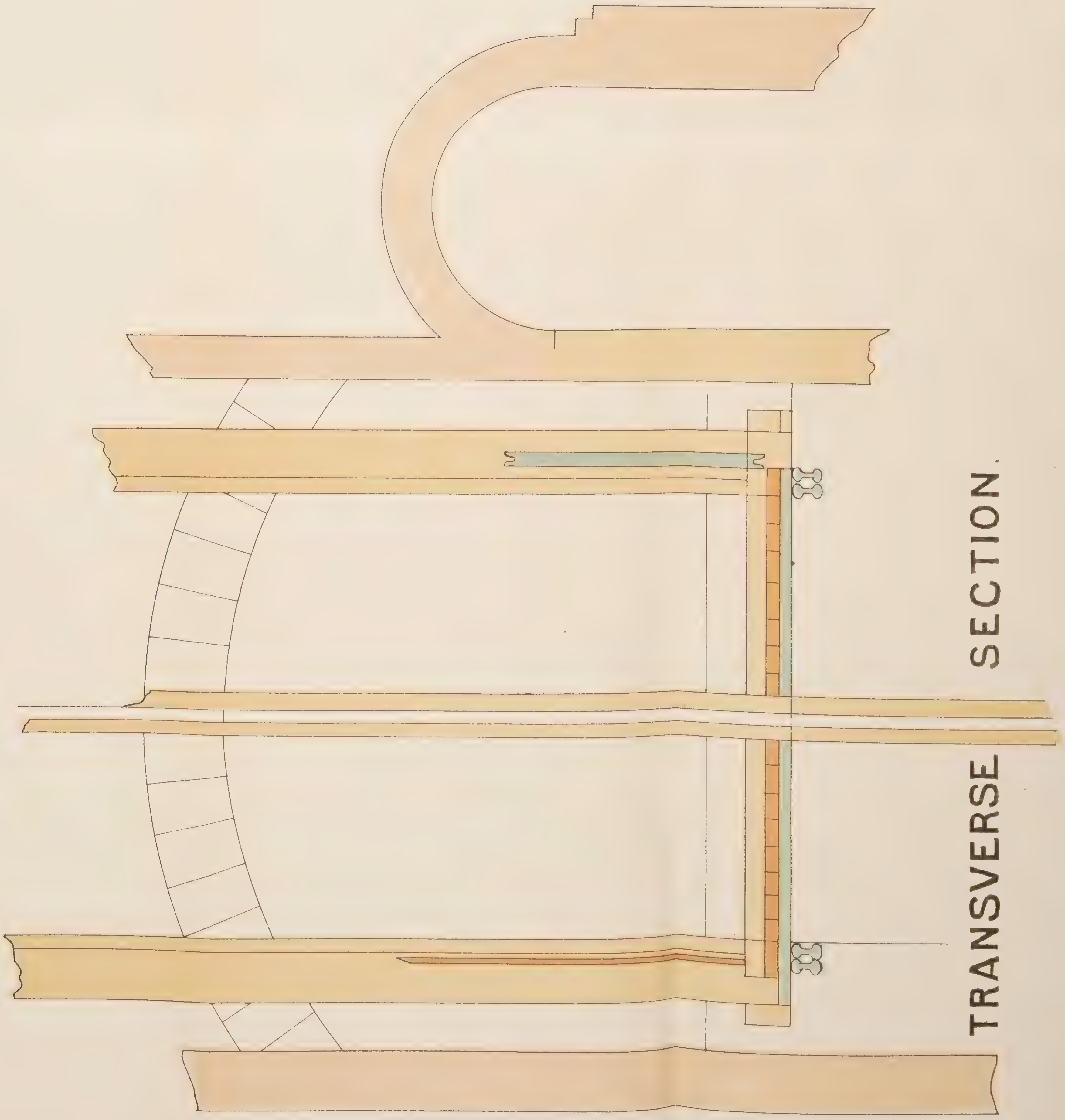


PORCH.

UDINAL
SECTION.

PORCH.





TRANSVERSE SECTION.

Frank. N. Wardell.

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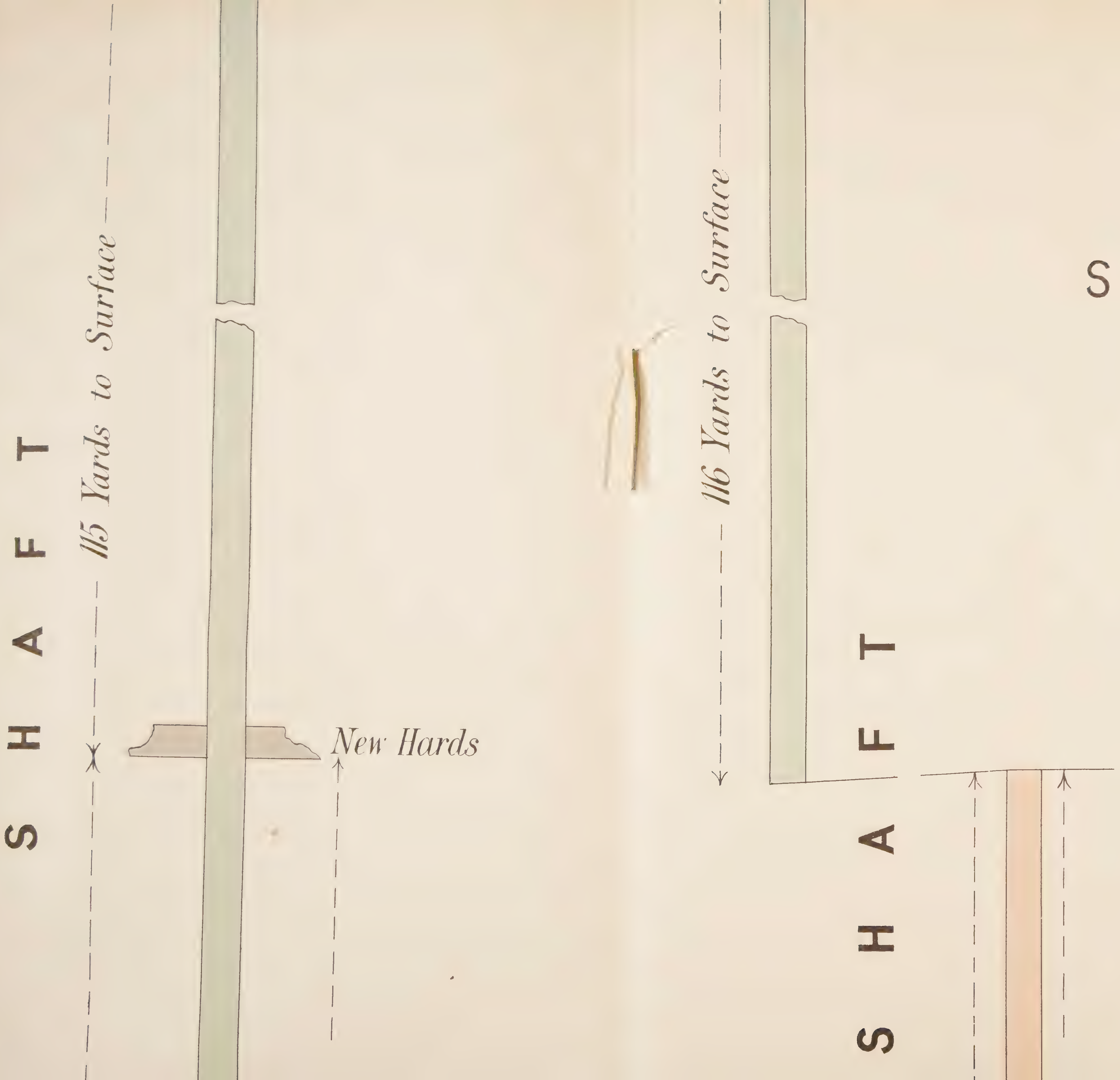
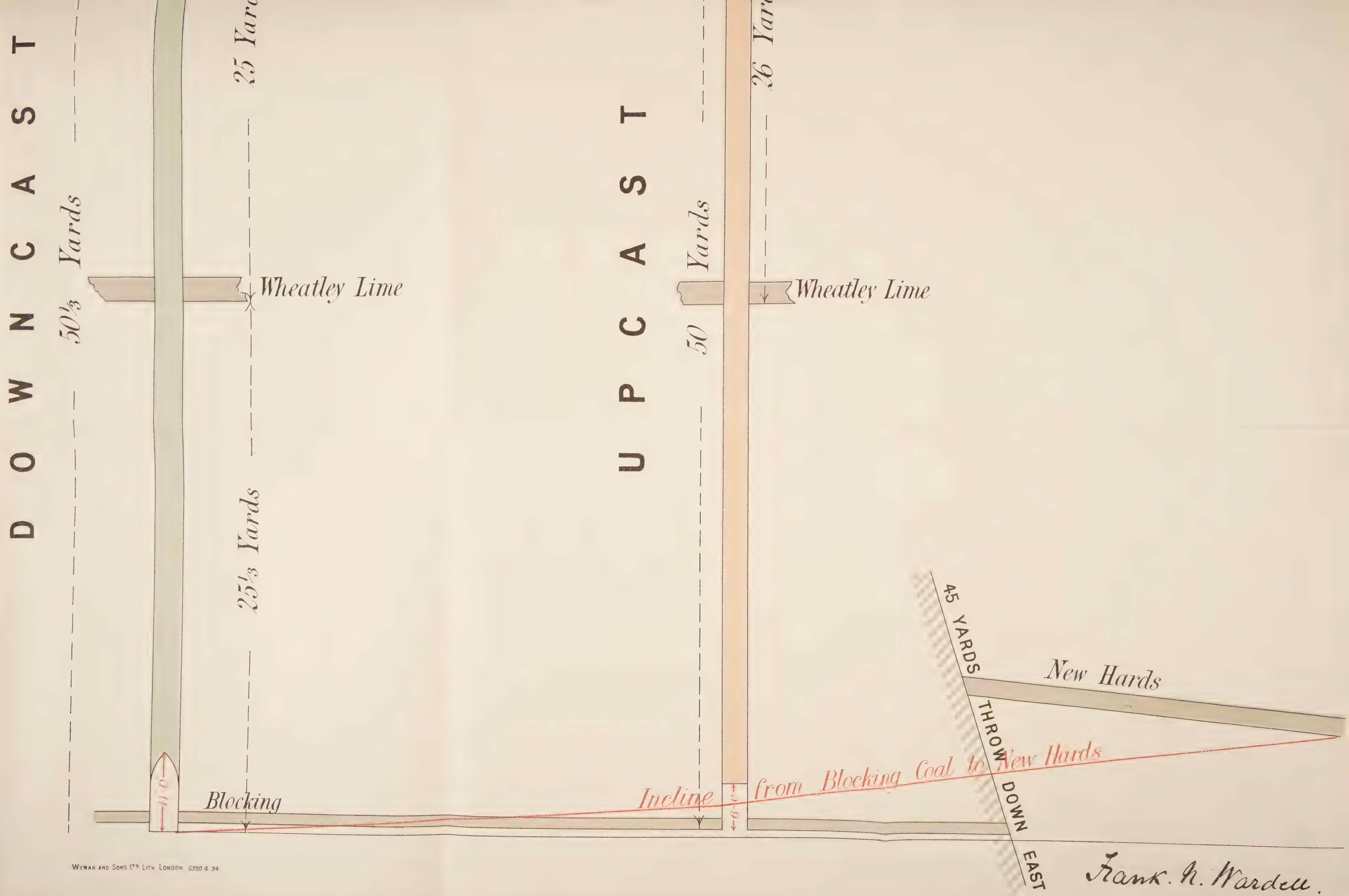
COMBS PIT

SECTION OF SHAFTS

Horizontal Scale ½ Chain per Inch.

Vertical Scale 10 feet per Inch.





Wyman and Sons Ltd Lith London 5920.4.94

Frank N. Wardell.

There could only have been a comparatively small quantity of gas, judging by the effects. Had it been otherwise the shaft above, the cages, and conductors would have suffered.

Further, it could not have come from any other place, for if it had come over the water at the at topof the incline in the Blocking bed, it would have passed up the staple pit, but neither the top or bottom of this pit nor in the shaft itself was the slightest trace of explosion to be found.

The explosion of the firedamp alone would have caused little damage, and probably no loss of life would have resulted, but unfortunately the flame setting fire to the wooden conductors caused a dense smoke to be carried into the workings of the Wheatley seam by the ventilation, and this it was, in conjunction with afterdamp, which suffocated those engaged there. Only seven remain alive out of the 146 persons then at work. The survivors stated that they knew nothing of anything being wrong until they suspended work some two hours after the explosion, and on coming towards the shaft they met what they described as a white mist with a peculiar smell, which affected their breathing, and eventually put out their lights.

In conclusion, we think it important to draw attention to the fact that open lights were used at the mouthing of the Wheatley seam after gas had made its appearance there, on more than one occasion, and it was one or other of these open lights which brought about the explosion.

We are of opinion that the law as to the use of safety lamps should be stricter and more definite.

We are also of opinion that, so far as possible, all wooden fittings should be avoided in colliery shafts, and that the maintenance of efficient appliances for extinguishing fires should be made compulsory at all mines.

We have, &c.

(Signed) FRANK N. WARDELL.
HENRY HALL.

The only other accident from explosion of gas attended with fatal consequences during the year took place at the New Sharlston Colliery on the 1st May. On this occasion three poor fellows lost their lives.

A shaft had been sunk to prove the Silkstone seam at a depth of nearly 600 yards. A drift was driven in this seam to a point about 80 or 90 yards from the shaft. There were no other workings or openings whatever. Three men only were employed, two men named Phelps, father and son, and a man called Wood. The elder Phelps was in charge, and it was his duty on descending to the bottom of the shaft with the other two each morning to leave them at the scaffold or station until he had examined the drift with a safety lamp, after which all used naked lights. On the date above named the three men descended in the usual way about 6 o'clock, Phelps having a locked safety lamp with him. About 20 minutes afterwards the explosion took place, the report resembling the crack of a rifle. The space being so confined where the gas ignited, the effects in the shaft itself were very serious. Timber at the landings had been broken up, and had fallen down, together with broken stays, signal wires entangled with the winding rope, and about 150 yards of air-pipes (used for the purpose of ventilating the drift by means of a fan), consequently the shaft for a considerable distance from the bottom was completely choked, and the operations connected with the descent in order to recover the bodies were attended with much risk, and were necessarily very slow and laborious. The younger Phelps was found under the débris at the bottom of the shaft the same night. He was alive when rescued, but died shortly after he was taken home. The bodies of his father and Wood were subsequently recovered, the former close to the shaft and the latter about 30 yards up the drift. How the explosion actually occurred could not be ascertained.

The men had always worked with naked lights. No gas had previously ever been seen in the pit, and no gunpowder or explosive of any kind had been used for nearly a month. The fan was stopped on the Saturday night until 5 o'clock on Monday morning (the day of the accident), but as it was thus at work for an hour before the men went down, that appeared amply sufficient to meet the requirements. The whole matter was most carefully sifted at the inquest, and a verdict of accidental death returned.

Three men, sinkers, were killed in a sinking shaft at Warren House Colliery, belonging to Messrs. John Brown & Company, on the 18th August, by falling out of the hoppit, or trunk, whilst descending the shaft. How the accident arose was a mystery, and can only be a matter of conjecture. The shaft was sunk to a depth of about 250 yards, and at the time of this lamentable occurrence the shifts were being changed. Nine men and the contractor were in the bottom, and four men, including the charge man, were descending in the trunk. They left the surface in the usual way, and appeared to descend smoothly and steadily, but when about 50 yards from the bottom, the trunk, by some means, must have caught one of the ventilating pipe bearers, and three of the men were upset, falling to the shaft bottom, the fourth man holding

fast and remaining in the trunk. He was shaken and seriously injured, but eventually recovered, though his mind, with regard to the accident was a perfect blank, and he could give no information whatever at the inquest, which had been adjourned for the purpose of examining him, as to anything which occurred in the shaft. What first caused the rope to swing could not be ascertained. There was a distance of 3 feet 6 inches at the nearest point between the side of the trunk and any bearer in the shaft, and the trunk, which was attached to one of Elliott's locked coil ropes, did not turn half round in the whole descent. I carefully examined the shaft and all the appliances, and it seems inexplicable that the trunk should have struck one of the wooden bearers, as it evidently had done. I never ascended or descended in a trunk in a sinking shaft where the motion was more smooth or where there was less oscillation.

It was most providential that no one of those at work at the time in the bottom of the shaft was injured by the falling men.

On the 12th January two men, colliers, lost their lives owing to a fall of roof in Orgreave Colliery, near Rotherham. They were working at a longwall "face" in the Silkstone seam. One of them, Ogden, was preparing to set a bar, having taken off a little coal in order to do so, the other, Turner, was filling from the holing, which was properly spragged. Apparently the getting down of this coal in order to set the bar had shaken the roof, for a fall of stone took place, without any warning, burying both men and killing them. The fall was about 18 feet long, and 3 feet 6 inches wide, and came off to a "slip" at the edge of the gate packs.

Props were set to within about 3 feet of the face, and there were more ready for use at hand. The "slip" did not seem to have been observed before the fall took place, in fact I do not think it could have been seen. A deputy visited the men about an hour and a half before the accident, and stated that he then considered the place to be in a safe condition and satisfactorily timbered.

G. Stephenson, collier, and W. Jones, hurrier, were killed by a fall of roof in the Queensbury Colliery, near Halifax, the property of Messrs. Briggs & Son, on the 4th October.

This colliery is nearly worked out, and these men were taking out a pillar of coal near the bottom of the shaft. There were only five persons, including the deputy, in the pit. Drake, the deputy, examined the place about 7 a.m., just before the men commenced to work, and he could not then discover nor anticipate any danger. The post was 5 yards wide, with one fast side, and there were packs within about 6 feet of the face. No props were set in this distance though there were several loose ones lying there ready for use, and, in my opinion, it would have been safer to have set two or three, even though the roof seemed to be hard and strong. The fall took place suddenly, about 8.30 o'clock, killing the two men. It was nearly an hour before their bodies were able to be recovered. It is always better to err on the side of safety, and to set props even when the doing so may appear to be an unnecessary precaution.

An instance of the simple way in which accidents are sometimes brought about by carelessness or hurry was given at the Silkstone Pit, Whitwood Colliery, on the 20th January.

Albert Hutchinson was employed as a banksman at this pit, and on the date above named he attempted to strike the catch lever with his foot in the top deck of the full cage before it rested on the fallers, in order to get the full tubs out with greater speed. The bottom deck had been already dealt with. It unfortunately happened that Saunderson, the other banksman, was too late with the "fallers," and consequently the cage descended below them. As Hutchinson had his foot in the position described, he was knocked down, and the top shoe of the cage caught his legs, almost cutting one of them off. He died shortly after admission into the Leeds infirmary, where he was at once taken. It was shown that two of the assistant banksmen had on previous occasions cautioned Hutchinson about the danger of putting his foot on the lever whilst the cage was in motion.

An accident occurred at Houghton Main Colliery, near Barnsley, on the 26th April, resulting in serious injury to three men, one of whom, George Patterson, died on the following day.

Patterson, who was a joiner, was, with other men, engaged in the examination of the wire rope conductors at the up-cast shaft. There were six of these, and the one being examined at the time of the accident was clamped at the low landing, in order that it might be unfastened at the head-gear and lowered 2 or 3 feet. The conductors passed through balks of timber about 2 feet 6 inches in thickness, and the above arrangement was necessary in order that that part of rope could be examined which was usually within the balk. The engine-wright, who was present at the time, went to the low landing to see if the clamps there held securely whilst the permanent clamps at the top were unloosened. He had hardly got there when one of the conductors fell down the pit with a sudden rush, only just missing

him in its descent, and on his rushing to the top to see what was the matter, he found that the joiners had, instead of unfastening the conductor already clamped at the low landing, liberated one of the others, and which had 40 yards of loose rope at the end of it. This had by the sudden rush coiled and twisted in all directions, knocking the men down who were engaged there and injuring them severely, in Patterson's case so much so as to cause his death. It was wonderful, and most providential, they were not all knocked down and dragged into the shaft. The men engaged in this work were all capable and experienced, and Patterson was thoroughly aware of the positions of the conductors. The mistake which was made was quite unaccountable.

David Perryman, a hurrier, employed at Wombwell Main Colliery, met with his death whilst at work there on the 6th May, under the following circumstances:—The Parkgate seam was being opened out, a heading having been driven on each side of the shaft a distance of about 10 yards. There was a sump at the bottom of the shaft about 22 feet in depth, and containing, at the time of the accident, 7 feet or 8 feet of water.

In order to prevent the water from rising too high it was drawn at intervals by means of a "kibble," which passed through a hole 5 feet square made for the purpose in the sump covering. The coal worked from the headings was also being drawn, and at such times, the water kibble being not then required, a "kibble" was fixed at the mouth of each heading in order to prevent any workman from walking into the sump. This had been done before the accident occurred, and the man in charge of the pit bottom had also cautioned all the men, and told them the lid was off the sump covering, as they were about to draw water. A "kibble" at this time was sent down with timber in it, and as there was a message written on it in chalk, the hanger-on called to Perryman asking him to come and read it. Perryman left the face of the heading to do so, but left his lamp behind, and came in the dark. On getting to the kibble, which was acting as a fence, he pushed through between it and the side, and fell into the sump. The hanger-on never saw or heard him before he fell, and the body was recovered from the water in about 25 minutes. The space through which Perryman pushed himself at the side of the "kibble" was only 9 inches wide. The jury at the inquest returned a verdict of accidental death.

A shocking fatality took place at Manvers Main Colliery on the 18th December, when one of the night banksmen named Sherwin fell down the shaft.

About 10 o'clock p.m. the engineman began to draw water in tubs which were placed in the cages. It was the duty of Sherwin to take the full tubs out of the cages, empty them, and put them back. This work proceeded until about 2 o'clock a.m., when the engineman found it necessary to alter some "packing" on the drum. In order to do this he raised the cage about 3 feet 6 inches above the "fallers," and let it remain there. He informed Sherwin what he was about to do, who was heard to reply, so there is no doubt as to his having understood what was intended. He emptied the water tub, and brought it back intending to put it into the cage in the usual way. The cage having been raised, he actually put it into the shaft, and was no doubt dragged down by it. I do not suppose he ever looked to see or noticed where the cage was, and did what he did unthinkingly. Ordinarily the shaft entrance is protected by self-acting gates, which rise and fall with the cages, and when, for the purpose of repair, or for any other reason, the cages are raised above the fallers and kept there, then chains, which are kept fixed to one side, are hung across to the other side, thus forming a fence and protection. This should, of course, have been done on the night in question. Had Sherwin fixed this chain in position he would, in all probability, not have lost his life. There was a very good light all round about the shaft. The work was such as Sherwin had been regularly accustomed to, and he had, on all previous similar occasions, properly fixed the chain. He was an experienced man, and had been banksman at this colliery for more than 17 years.

Daniel Shaw, an assistant pump man, was killed in the pumping shaft at Tinsley Park Colliery by falling from one scaffold to another on the 20th December. He and Buckley, the master pump man, went down to pack the glands of the first and second sets of pumps, at depths of 60 and 95 yards. Having completed the work, Shaw ascended from the lower scaffold where they then were to the higher one, and then sent the loop down again for Buckley, who came up in it, passed Shaw, and intended to go straight up the surface. When within a few yards of the top, however, he heard a noise below him, and he called out to Shaw, but not receiving any reply, he again descended, and found, to his surprise, Shaw was not on the top scaffold. He then descended to the lower one and there found him, having fallen a distance of 35 yards. Upon being questioned, Shaw could give no explanation except that he had slipped. Within very few minutes of Buckley reaching him he expired. I cannot account for the accident in any other way than that, as he said himself, he "slipped" whilst on the platform waiting for the loop. There was a key there, and he may possibly have been

tightening some of the top nuts of the gland and overbalanced himself. He had been accustomed to the work for several years, and was a thoroughly competent shaft man.

An accident of a somewhat peculiar nature took place in the Parkgate pit of the Nunnery Colliery on the 13th January. Two men, Hind and Lloyd, were baling water from an old dip board opening off the main level. About 9 o'clock p.m. Lloyd was taking away one of the tubs they had filled, when Hind ran after him, saying he was burned. The men were not more than 9 or 10 yards from each other. They were using open paraffin lamps. After very careful investigation, I came to the conclusion that Hind, when stooping over the water in which he was working, must have upset his lamp, and the oil falling on the water and becoming ignited, the flames would dart up at once and burn him. He was never able to give any account himself of what happened, as he never sufficiently regained consciousness. There were no indications whatever consistent with the theory of an explosion of firedamp. The injuries on the man's body appeared to be from flame having licked round him when in a stooping position. The pit is now only a very small one, and worked entirely by naked lights. Lloyd said he heard no noise at all, and from where he was working at the time could see Hind. No gas had been seen in the district for at least 10 years, nor has any been seen since. Hardwick, a deputy, was with these two men till within 20 minutes of the accident, and he then made a careful examination with a safety lamp, but could find no trace of gas. A careful examination of the place after the accident revealed no evidence whatever of any explosion of gas. The jury at the inquest returned a verdict of accidental death, probably owing to being burned by paraffin.

A stone miner named Mortimer died on the 15th March from injuries he had received 12 days previously by an explosion of gunpowder in the Popplewell Pit, belonging to the Low Moor Company, another man, named Aspinall, being at the same time seriously injured. On the night of the 3rd March these two men were working in a drift. They had drilled a hole in the roof and were charging it with gunpowder. John Marsden, a hooker-on, was working about 40 yards from them. He heard a shot go off, and guessed something was wrong because they had not told him to keep back the hurriers as they always did before firing a shot. He went at once to the place, and found both men about 8 yards from the face badly injured. They were quite conscious, and, in reply to a deputy who had arrived, they said they could not account for the accident. The shot hole was not in solid stone, but in "broken" ground. Aspinall, who was in charge, stated that they had put the cartridge in all right, and having put a piece of paper after it, proceeded to ram the charge, Mortimer striking the rammer, when an explosion immediately took place. Mortimer confirmed this statement. Upon examination there was nothing unusual to be found at the "face." The broken ground had not been brought down by the shot, which had evidently come stright out of the hole, the rammer lying 6 or 7 yards away. A can containing unexploded cartridges was close by. The rammer, like all others in use in the pit, was made of wood. The cartridges were made of the ordinary blasting powder. The charge could not have been rammed up tight, because if so the stone would have been brought down. No further light could be thrown on the matter. Both men were thoroughly competent and experienced workmen.

An unfortunate accident occurred at Cadeby Colliery on the 20th March, whereby a deputy named Nelnes lost his life owing to suffocation by gas. This colliery is a new winning in connexion with Denaby Main Colliery. One shaft had at the time been sunk to the coal, a depth of between 700 and 800 yards, the other was not then down. The whole work of sinking had up to this time been completed without the occurrence of a single fatality, and this poor fellow, if he had exercised ordinary care, would not have lost his life. A heading had been driven a length of about 95 yards from the shaft, the last 12 yards being at right angles to the other portion. It was ventilated by means of a fan on the surface, the air being conducted to the face by pipes. The heading was driven for the purpose of a connexion between the two shafts, so soon as the second one reached the coal, and as gas had been giving off for a fortnight previously, it was stopped and fenced off. Every morning the place was examined by deputies, together with either the manager or under manager. On the morning in question Nelnes, with the under manager, proceeded to make an examination as usual, leaving six or seven men at work at the bottom of the shaft. After going about 70 yards, Campbell, the under manager, lowered his light to test for gas, and Nelnes walked past him. Campbell called out to stop him, and at that moment Nelne's light went out. He continued to walk on, notwithstanding Campbell's remonstrances, and must have been overcome immediately by the gas. Help was procured, and the manager, with six or seven men, used every endeavour to reach Nelnes, but about six hours elapsed before they were able to do so. Very considerable risk attended their efforts, and one of the rescuers nearly lost his life in the attempt, being overcome by the gas.

At Wood Pit, near Holmfirth, Charles Haigh lost his life on the 1st November through the explosion of a shot. In this case also, as in the last described, the unfortunate man was a deputy, and no person but himself could be blamed for the occurrence. About 9.30 a.m. Haigh charged and lighted a shot in the "ripping" of a new hurrying road. It missed fire, he therefore fenced the place off. The manager, on being told of this half an hour afterwards, directed him, in the presence of a man called Robinson, not to return to the missed shot until the following day, and to have the place fenced. On this same day, however, Haigh was fatally injured by the explosion of the shot whilst he was in the act of wedging down the ripping which contained the missed shot. Clearly he must have returned to the place some two hours after having seen the manager, and commenced to wedge, for on examination afterwards of the wedge and pick marks, he had cut at least 2 feet of the "ripping," and had reached within about 9 inches of the back of the hole when the shot exploded.

I received information in 1893, as in other years, of certain fatalities, a list of which I append, in accordance with my usual custom, although the circumstances under which they occurred do not bring them within the meaning of the Mines' Regulation Acts.

One of the deputies at Warren Vale Collier, near Rotherham, after having made his examination of the workings on the 5th January, fell down in an apoplectic fit. He died the same day.

George Platts, a collier, employed at Rockingham Colliery, died suddenly from heart disease, at the bottom of the shaft, on the 13th January, whilst standing there after his work was finished, waiting his turn to come out.

A man named Limbert died on the 1st February, and it was alleged that he had received injury at the Garforth Colliery in July 1892. No accident had been reported, nor were the officials aware of such having taken place.

There was some doubt as to the cause of death in the case of a boy named Marsh, who was said to have received injury in the Ravenslodge Pit, near Dewsbury, on the 4th February, and the verdict returned at the inquest was to the effect that there was not sufficient evidence to show the cause of death.

Andrew Cunes died in the infirmary at Leeds in March, and said that he had fallen down in St. John's Colliery in January and hurt himself. No one in authority at the colliery knew anything about this. He appeared to have gone to the infirmary in February. The doctor stated that he was suffering from blood poisoning, which might have been produced by his falling upon a rail.

On the 13th March W. Durkin, a surface labourer at Rockingham Colliery, was pushing a full corf across some flat sheets, having his back against it, and thus walking backwards, when he was seen by an engineman to suddenly raise himself up and then fall forward on to his face. He was at once picked up, but life was extinct.

A death occurred from natural causes in Manvers Main Colliery on the 20th March. Thomas Smith, a collier, whilst at work there was taken ill and died.

The death of a man named Beechill in May was stated to have been caused by injury received on the surface at East Gawber Colliery in September 1892. The doctor, who had made a post mortem examination, however, stated at the inquest that death was the result of consumption, and had not been hastened by accident.

A furnaceman, called Watson, had an apoplectic fit in the Fryston Colliery on the 19th May whilst at his work, and died the same day.

An old man named Beevers was run over on a railway belonging to the Lidgett Colliery, on the 2nd June, by a locomotive and waggons, and killed. He was not employed by the colliery company, but was a fitter at some brickworks in the neighbourhood.

Joseph Jackson, an ironstone miner, employed by the Bowling Iron Company in the Roads Pit, died whilst at work there on the 16th June from natural causes; he had been in ill health and under medical treatment for some years.

A similar event occurred in Kiveton Park Colliery on the 20th June, where James Ricketts, a collier, died suddenly soon after descending the shaft.

Also at Elsecar Collieries, a case of death from natural causes, took place on the 12th July, the deceased being employed to grind the corn.

At Aldwarke Main Colliery, O. Williams died on the 31st August. He had been employed there as a sinker and drifter, and had received injury in March 1892.

A labourer employed at Wharncliffe Silkstone Colliery, named Camplin, died there suddenly whilst eating his dinner, from disease of the heart.

James Woolton died on the 18th September. He had been employed at Carr House Colliery and received injury there in July 1892.

A death from natural causes took place in the Lofthouse Colliery on the 15th December. A. Rushfirth whilst at work there fell down and died in a few minutes.

Similar events occurred at Hoyland Silkstone Colliery on the 18th and 20th December, on each of which days a man died whilst following his usual occupation. In the first case the breaking of a blood vessel was the cause of death. In the second, inflammation of the brain.

George Evans, a collier, who had been employed at Ryland's Main Colliery, died on the 29th December. He had received some injury whilst following his employment in October 1890.

The following is a list of the mines in my district which have, up to the present time, received exemption under the 1887 Act from the weighing clause under section 12 (3) from the Secretary of State, with the date of such exemption:—

Name of Colliery.	Name of Owners.	Where situate.	Date of Exemption.
Blocking Coal, Dayhole	Park Coal Company	Dewsbury	May 29, 1888.
Nun Brook	" "	"	" 29, "
Beevers, Gawber	C. Beevers	Barnsley	" 28, "
Clough, Deepcar	J. Gregory	Sheffield	" 28, "
Black Bed, Wortley	J. Cliffe & Son	Leeds	" 28, "
Brickfield, "	" "	"	" 28, "
Thorncliffe Green	Lodge & Hall	Huddersfield	March 5, "
Colne Bridge	Charles Wheatley	Mirfield	May 16, "
Heaton Hall	" "	"	" 16, "
Deepcar	J. Armitage	Sheffield	June 14, "
Box Moss	Seth Senior & Sons	Huddersfield	" 14, "
No. 3 Drift, Emley	Jaggar & Co.	Wakefield	" 16, "
Speedwell, "	" "	"	" 16, "
Lodge Farm	Holt, Thomas, & Heeley	Bradford	" 18, "
Fall Lane and Woodside	Bill Hanson	Dewsbury	" 7, "
Booth Holme	J. & D. Mosley	Bradford	" 6, "
Falhouse	T. & F. Bedford	Dewsbury	" 7, "
Shipley Clay Mine	J. R. Fyfe & Co.	Bradford	" 22, "
Moor Side, Shelley	F. Shaw & Co.	Huddersfield	" 22, "
Holly Park, Calverley	Holly Park Mill Co.	Bradford	" 20, "
Cockermouth	Jesse Jaggar	Wakefield	July 2, "
Red Hill, Tong	Terry & Rushforth	Bradford	" 2, "
Shipley Coal Mine	J. R. Fyfe & Co.	"	" 11, "
Howroyd, Priestfield	John Cutt	Dewsbury	Sept. 8, "
Hopton Mill, Mirfield	Wheatley & Sons	Mirfield	" 8, "
Calder, Elland	E. J. W. Waterhouse	Halifax	" 27, "
Westfield, Ossett	Westwood Coal Co.	Wakefield	Nov. 20, "
Woodhouse Lane, East Ardsley	Woodhouse Lane Colliery Co.	"	" 22, "
Toppit	J. W. Taylor	Huddersfield	Jan. 3, 1889.
Wharncliffe, Pot Clay	Grayson, Lowood, & Co.	Sheffield	Dec. 18, "
Northorpe	Mirfield Coal Co.	Mirfield	" 19, "
Threshfield	W. & J. Dolphin	Skipton	April 5, 1890.
Hopton Mill	H. Wheatley & Sons	Mirfield	June 10, "
Arborthorne	Duke of Norfolk	Sheffield	Oct. 23, "
Cliff Bridge	Cliff Bridge Colliery Co.	"	April 26, 1892.
Coney Wood	Bowling Iron Co.	Bradford	Aug. 27, "
Beacon	Oates & Green	Halifax	" 31, "
Mytholm	" "	"	" 31, "
Field	" "	"	" 31, "
Birks	John Morton & Co.	Bradford	Sep. 23, "
Fogshaw	J. Cradock	Pateley Bridge	June 9, 1893.
Lumb Lane	Thornton Bros.	Bradford	Sep. 27, "

The following return shows the number of mines at work under the Coal and Metalliferous Mines Regulation Acts in Yorkshire and Lincolnshire during the year 1893, the number of persons employed in and about the mines, the tonnage of mineral raised therefrom, also the tonnage of certain minerals got from operations not coming within the scope of these Acts:—

Under the Coal Mines Act.						Under the Metalliferous Acts.					Totals under both Acts.			
Number of Mines at Work.	Persons Employed. Under-ground. (A.)	Persons Employed. Above-ground, including those on Sidings at the Pit. (B.)	Persons Employed. On Private Branch Railways and Washing and Coking Coal (C.).	Persons Employed. Total (A., B. and C.).	Tons of Mineral wrought.	Number of Mines at Work.	Persons Employed. Under-ground.	Persons Employed. Above-ground.	Persons Employed. Total.	Tons of Mineral wrought.	Number of Mines at Work.	Persons employed in and about the Mines, including (A., B. and C.).	Tons of Mineral wrought.	Tons of certain Minerals obtained from Open-works.
424	71,529	14,912	2,258	88,699	16,383,309	62	321	554	875	60,021	486	89,574	16,443,330	993,894

TOTAL NUMBER of COLLIERIES in YORKSHIRE and LINCOLNSHIRE, 424.

—	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Total number of days worked by the 424 collieries.	9,401	8,429	9,030	7,470	7,701	8,043	8,936	3,127	2,177	4,415	6,484	9,149	84,362
Average number of days worked per colliery.	$22\frac{1}{7}$	$19\frac{6}{7}$	$21\frac{2}{7}$	$17\frac{4}{7}$	$18\frac{1}{7}$	19	21	$7\frac{2}{7}$	$5\frac{1}{7}$	$10\frac{3}{7}$	$15\frac{2}{7}$	$21\frac{4}{7}$	—
Total number of days worked per colliery.	—	—	—	—	—	—	—	—	—	—	—	—	199

Great and rapid strides have been made of late years in the advancement of scientific knowledge, and in the adoption of improved appliances at collieries for the purpose of insuring a greater amount of safety; and it is to the advantage and for the benefit of all, both managers, owners, and workmen, that every encouragement should be given, and every effort made to still further develope such knowledge and appliances. Notwithstanding the acknowledged fact that the degree of safety in coal mining is infinitely higher than it was formerly, yet it is terribly distressing to find ourselves suddenly plunged into the grief caused by such an accident as that which at Combs Colliery resulted in a loss of 139 lives. We are led to hope from time to time that the tide of destruction is beginning to ebb, when some terrible calamity, such as this, at once, and in the most unmistakable way, dispels the illusion. The only way in which to combat these fatalities from explosion of gas, is to maintain the best ventilation, to use the best known form of safety lamp, securely locked, and to ensure the direction of operations by competent officials. Co-operation, carefulness, and attention to rules on the part of the workmen themselves, is absolutely necessary. Ventilation ought to be sufficiently adequate to meet extraordinary circumstances which may arise, such, for instance, as a sudden eruption of gas. All roads should be sufficiently large for the purpose of ventilation, and the several districts should be fed, by means of splits, with currents of fresh air. By splitting the air judiciously, the quantity of it passing through the various workings can be considerably augmented, and the friction reduced. It must be always remembered, however, that unless a perfect system of discipline exists in a mine, all other precautions are likely to prove more or less abortive.

The existence of dust in a mine is becoming every year more and more an acknowledged element of danger, and especially when gas is given off. That by the means of dust an explosion, owing its initiation, perhaps, to gas, can be spread over large areas, and be enormously aggravated, there can be no doubt whatever; and although many persons are sceptical as to the capability of dust, *per se*, causing an explosion, it is admitted that a very small percentage of gas is sufficient for the purpose—so small a percentage, in fact, as to be undiscoverable by the ordinary mode of testing with a safety lamp. There is no doubt that the question of dust is a very grave one, and equally with that of gas should receive the most careful attention. The abolition of gundowder from mines, if a very drastic measure is to be adopted, seems to be the safest and most desirable. The use of high explosives might be substituted. The result of experiments made by my colleague, Mr. Hall, in Lancashire, and at some of which I was myself present, distinctly proved that certain high explosives do not ignite or explode coal dust.

In speaking of gas or coal dust, I do not forget that in ordinary years the most prolific source of danger is embraced under the heading "falls of roof and sides." In order to guard against accidents which arise from falls, a more extensive and abundant use of timber should be insisted on, and it should be set in a more uniform manner. If timber were set at regular intervals, whether it appeared to be wanted or not, and however safe the place might seem to be, I think the loss of life from this cause would be materially diminished. I do not say accidents of this nature would cease to occur, for no doubt many happen which neither skill nor care would suffice to prevent; but the regular and systematic setting of timber, especially in the working places, for it is there principally where falls occur, would tend to check them. This system, so far as holing sprags is concerned, is already enforced by special rule in this district, and has materially lessened the number of accidents from falls of coal. Accidents from falls can be better guarded against, as a rule, by the workmen themselves than by any supervision, even though this be, as it ought, as strict and frequent as possible, and yet it frequently happens that the most experienced and careful workmen are the victims. Many falls occur by reason of "slips" or "partings," which cannot be observed beforehand,

and it frequently happens in such cases a collier is instantaneously crushed to death, however experienced and vigilant he may be. One way by which it appears to me this danger can be minimised is, as I have mentioned, by the regular fixing of timber at stated intervals. By adopting this principle, whether the roof indicates weakness and danger or not, there would, I think, be a decrease in the loss of life. It is most desirable, also, that every working place should be properly and carefully examined, not only before the workmen commence, but also at as frequent intervals as possible during the progress of the shift. This constant supervision must in all cases be added to other essential precautions, for it is absolutely necessary, and to this must be added a complete system of discipline and attention to rules on the part of the workpeople.

I am of opinion that in any amendment of the Mines Acts, the rules affecting the use of safety lamps should be made more stringent; and I think that in all mines where gas had been seen within the preceding 12 months they should be exclusively used. This would prevent the use of naked lights even at the bottom of the downcast shafts.

It appears to me desirable also that, so far as practicable, the use of wooden fittings in shafts should be done away with, and that appliances of some kind, in the shape of "extincteurs" or a supply of water should be kept at hand to deal with fire about shafts or in underground engine-houses or stables at its first outbreak.

There has been no fatality at any of the ironstone mines in either Yorkshire or Lincolnshire during the year.

I would repeat here my advice expressed on previous occasions, that some method should be adopted whereby the workmen would be able, in cases of emergency, to ascertain the way of exit from the pit by the returns. The arrangement would be very simple, and at present most of them only know the road by which they are accustomed to go to and come away from their places of work each day, which is, generally speaking, the intake airway.

I have forwarded to you during the year reports of proceedings taken against persons employed in and about mines, which have been sent to me, in accordance with the 66th section of the Act They were taken at 24 collieries, and involved 48 separate offences.

The beneficial results accruing from a knowledge of the requisite first aid to be rendered in cases of accident, and imparted through the medium of the St. John Ambulance Association, continue to be more and more widely felt, and indeed I cannot speak too highly of the efforts of this Association, and of the incalculable good the information thus disseminated has done and is doing.

As regards the treatment of animals underground, I can again testify to the fact that it continues to improve. Very few cases indeed of ill-treatment have reached me, and, generally speaking, animals are well cared for, and humanely and kindly looked after.

I received 397 notices of accident, both fatal and non-fatal, during the year, under both the Coal and Metalliferous Mines Acts.

Fatalities occurred at 50 out of the total number of collieries (424) in the district —that is to say a proportion of about 12 per cent.

The following table shows the hour of the shift in which each fatal accident occurred in this district during the year 1893.

Underground.								
1st Hour.	2nd Hour.	3rd Hour.	4th Hour.	5th Hour.	6th Hour.	7th Hour.	8th Hour.	9th Hour.
7	6	8	7	4	8	9	7	—

Aboveground.									Total Number of Accidents.
1st Hour.	2nd Hour.	3rd Hour.	4th Hour.	5th Hour.	6th Hour.	7th Hour.	8th Hour.	9th Hour.	
2	3	—	2	4	1	2	—	3	74 (including one not during his working hours.)

No fatal accident occurred in Lincolnshire during the year, and I have no observations to make specially referring to that portion of my district.

There is an increase of 8 in the number of collieries in this district, the total number now being 424.

8,146 persons under the age of 16 were employed during the year in and about the mines in this district, equal to a proportion of 10·9 of the total number.

The number of females employed on the surface remained the same as in the last four years, namely two.

I have, &c.
FRANK N. WARDELL.

The Right Hon. H. H. Asquith, Q.C., M.P.,
Her Majesty's Principal Secretary of State.

Coal Mines Regulation Act.

List of the Fatal Accidents, and Deaths arising therefrom within One Year and a Day from the Date of the Accident, in Mr. Wardell's District, consisting of Yorkshire and Lincolnshire, during the Year 1893.

No. of Accident.	Date and Hour of the Accident.	Hour of the Person's Shift, i.e., No. of Hours he had been at Work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Firedamp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.	Total.
1	1893. Jan. 9 8 a.m.	2nd	Barrow - -	Barnsley -	Barrow Hæmatite Steel Co.	W. Yates -	25	Trammer -	Fall of stone - - -	–	1	–	–	–	1
2	Jan. 12 8.45 p.m.	7th	Orgreave -	Rotherham -	Rother Vale Coal Co. -	W. Ogden W. Turner	26 28	Stallman - Ditto -	Fall of coal - - - - -	– –	– 2	– –	– –	– –	– 2
3	Jan. 13 9 p.m.	7th	Nunnery -	Sheffield -	Nunnery Coal Co. -	J. Hind -	30	Water-filler	Burnt by paraffin from his oil lamp	–	–	–	1	–	1
4	Jan. 13 7.20 p.m.	5th	Thrybergh Hall	Rotherham -	J. & J. Charlesworth -	J. Whitehead -	19	Trammer -	Fall of roof; died 24th March -	–	1	–	–	–	1
5	Jan. 13 3 p.m.	9th	Crigglestone -	Wakefield -	Crigglestone Coal Co. -	A. Haigh -	14	Scale picker	Crushed by waggons - -	–	–	–	–	1	1
6	Jan. 18 3 a.m.	7th	Howley Park -	Batley -	Howley Park Coal Co. -	W. Brown -	16	Bye-work-man.	Fall of roof - - - -	–	1	–	–	–	1
7	Jan. 19 11.30 a.m.	6th	Kiveton Park -	Sheffield -	Kiveton Park Coal Co. -	W. Hayes -	27	Collier -	Fall of roof; died 28th July -	–	1	–	–	–	1
8	Jan. 20 11 a.m.	5th	Whitwood -	Normanton -	H. Briggs and Son -	A. Hutchinson	20	Banksman -	Crushed by cage; died 23rd - -	–	–	1	–	–	1
9	Jan. 20 9.15 a.m.	4th	Glass Houghton	Castleford -	T. H. Thorp - -	A. Westwood -	24	Collier -	Fall of roof; died 22nd - -	–	1	–	–	–	1
10	Jan. 23 4.30 p.m.	3rd	Oaks - -	Barnsley -	C. Cammell & Co. -	J. Ward -	56	Ditto -	Fall of coal - - -	–	1	–	–	–	1
11	Jan. 26 10 a.m.	4th	Nunnery -	Sheffield -	Nunnery Coal Co. -	J. Revill -	22	Ditto -	Fall of stone - - -	–	1	–	–	–	1
12	Jan. 29 9.55 p.m.	5th	Car House -	Rotherham -	J. Brown & Co. -	G. Milnen -	45	Engine man	Fell from ladder in engine-house -	–	–	–	–	1	1
									Total—January -	–	9	1	1	2	13

List of Accidents—*continued.*

No. of Accident.	Date and Hour of the Accident.	Hour of the Person's Shift, *i.e.*, No. of Hours he had been at Work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Firedamp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.	Total.
13	1893. Feb. 3 7 p.m.	2nd	Hartley Bank -	Wakefield -	F. Coal Co. - -	G. Jackson -	39	Engine man	By machinery - - -	–	–	–	–	1	1
14	Feb. 8 8.30 a.m.	3rd	Monk Bretton	Barnsley -	W. Pepper - -	G. Shepherd -	20	Trammer -	Injured by tubs; died 9th - -	–	–	–	1	–	1
15	Feb. 13 10.45a.m.	5th	Barrow - -	Ditto -	Barrow Hæmatite Steel Co.	T. Bostock -	25	Ditto -	Fall of stone - - - -	–	1	–	–	–	1
16	Feb. 14 8 a.m.	2nd	Whitwood -	Normanton -	H. Briggs and Son -	D. Clark -	40	Collier -	Fall of roof - - -	–	1	–	–	–	1
17	Feb. 16 10.50a.m.	4th	Acton Hall -	Pontefract -	Ackton Hall Coal Co. -	A. Hercock -	28	Labourer -	Injured by "legs" from centre pin, which broke.	–	–	–	–	1	1
18	Feb. 20 10.30a.m	5th	Oaks - -	Barnsley -	C. Cammell & Co. -	J. Evetts -	28	Ditto -	Strained himself; died 2nd March -	–	–	–	–	1	1
19	Feb. 22 7 a.m.	1st	Manvers Main -	Rotherham -	Manvers Main Coal Co. -	G. F. Dunhill -	15	Driver -	Injured by tub - - -	–	–	–	1	–	1
									Total—February -	–	2	–	2	3	7

List of Accidents—*continued.*

No. of Accident.	Date and Hour of the Accident.	Hour of the Person's Shift, i.e., No. of Hours he had been at Work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Firedamp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.	Total.
20	1893. Mar. 3 11.20p.m.	2nd	Low Moor -	Bradford -	Low Moor Iron Co. -	R. Mortimer -	44	Stone miner	Gunpowder - - -	–	–	–	1	–	1
21	Mar. 6 7.30 a.m.	2nd	Conyers -	Dewsbury -	G. & J. Haigh - -	G. Noble -	28	Collier -	Fall of stone - - - -	–	1	–	–	–	1
22	Mar. 14 8.30 a.m.	3rd	Car House -	Rotherham -	J. Brown & Co. - -	C. H. Whittington.	14	Driver -	Injured by tubs; died 15th -	–	–	–	1	–	1
23	Mar. 16 10.15p.m.	1st	Denaby Main -	Ditto -	Denaby Main Coal Co. -	J. Leak - -	42	Dataler -	Sprained his back whilst carrying a rail; died May 29th.	–	–	–	–	1	1
24	Mar. 17 12.30p.m.	7th	Monckton Main	Barnsley -	Monckton Main Coal Co.	J. Parks - -	47	Collier -	Fall of roof - - -	–	1	–	–	–	1
25	Mar. 20 6.40 a.m.	1st	Cadeby Main -	Rotherham -	Denaby Main Coal Co. -	G. Nelnes -	33	Deputy -	Suffocated by gas - - -	–	–	–	1	–	1
26	Mar. 22 1.30 p.m.	8th	East Ardsley -	Barnsley -	R. Holliday and Sons -	J. Lee - -	50	Collier -	Injured by tubs - - -	–	–	–	1	–	1
27	Mar. 27 1.45 p.m.	8th	Glass Houghton	Castleford -	T. H. Thorp - -	G. Shepherd -	22	Ditto -	Fall of stone - - - -	–	1	–	–	–	1
28	Mar. 27 10.0 a.m.	4th	Monk Bretton -	Barnsley -	W. Pepper - - -	M. Wyatt -	34	Filler -	Coal burst off loose end; died June 29th.	–	1	–	–	–	1
29	Mar. 28 8 a.m.	2nd	Rothwell Haigh	Leeds -	J. & J. Charlesworth -	G. Taylor -	49	Collier -	Fall of roof; died April 4th -	–	1	–	–	–	1
									Total—March -	–	5	–	4	1	10

List of Fatal Accidents—*continued.*

No. of Accidents.	Date and Hour of the Accident.	Hour of the Person's Shift, *i.e.*, No. of Hours he had been at Work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Firedamp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.	Total.
30	1893. April 11 10 a.m.	5th	Mitchell Main	Barnsley	Mitchell Main Coal Co.	— Atkins	15	Screen boy	By machinery	–	–	–	–	1	1
31	April 17 12 p.m.	6th	Warren Vale	Rotherham	J. & J. Charlesworth	F. Ellis	20	Collier	Injured by tubs	–	–	–	1	–	1
32	April 19 2 p.m.	8th	Monk Bretton	Barnsley	W. Pepper	J. Cooper	46	Bye workman.	Ditto	–	–	–	1	–	1
33	April 20 12.10a.m.	3rd	Thorncliffe	Ditto	Newton Chambers	B. Cooper	59	Labourer	Fall of roof	–	1	–	–	–	1
34	April 20 2 p.m.	8th	Whitwood	Normanton	H. Briggs and Sons	A. Wasbrook	28	Collier	Ditto	–	1	–	–	–	1
35	April 21 12 .5p.m.	7th	Robin Hood	Wakefield	J. & J. Charlesworth	E. Butterfield	24	Ditto	Ditto	–	1	–	–	–	1
36	April 21 11 p.m.	1st	Cortonwood	Barnsley	Cortonwood Coal Co.	A. Bagnall	31	Ditto	Fall of coal; died 26th	–	1	–	–	–	1
37	April 26 9 a.m.	3rd	Houghton Main	Ditto	Houghton Main Coal Co.	G. Patterson	29	Carpenter	Struck by rope	–	–	1	–	–	1
38	April 26 9.15 a.m.	4th	Victoria	Wakefield	V. C. & C. Co.	J. Clarkson	28	Collier	Fall of coal; died July 2nd	–	1	–	–	–	1
39	April 28 1 p.m.	7th	Sharlston	Normanton	New Sharlston Coal Co.	J. Fisher	49	Ditto	Fall of stone	–	1	–	–	–	1
									Total—April	–	6	1	2	1	10

List of Accidents—*continued.*

No. of Accident.	Date and Hour of the Accident.	Hour of the Person's Shift, *i.e.*, No. of Hours he had been at Work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Firedamp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.	Total.
	1893.														
40	May 1 2.0 p.m.	8th	East Ardsley	Wakefield	R. Holliday and Sons	J. Lancaster	54	Collier	Fall of roof; died 5th	–	1	–	–	–	1
41	May 1 6.20 a.m.	1st	Sharlston	Normanton	New Sharlston Coal Co.	J. Phelps	51	Ditto	Gas	3	–	–	–	–	3
						J. Wood	32	Ditto							
						S. Phelps	19	Ditto							
42	May 6 9.0 a.m.	3rd	Wombwell Main	Barnsley	Wombwell Main Coal Co.	D. Perryman	18	Trammer	Drowned in sump	–	–	1	–	–	1
43	May 8 1.30 p.m.	8th	Featherstone Main.	Pontefract	Featherstone Main Coal Co.	T. Roberts	14	Driver	Injured by tubs	–	–	–	1	–	1
44	May 9 1.30 p.m.	6th	Grange	Rotherham	Newton Chambers	C. H. Allott	20	Filler	Fall of roof	–	1	–	–	–	1
									Total—May	3	2	1	1	–	7
45	June 15 10.30 a.m.	5th	Elsecar	Barnsley	Earl Fitzwilliam	D. Royston	21	Trammer	Fall of roof	–	1	–	–	–	1
46	June 16 9.20 a.m.	4th	Wharn, Carlton	Ditto	R. Craik & Co.	W. Stubbin	29	Collier	Fall of coal	–	1	–	–	–	1
47	June 20 1 p.m.	7th	Whitwood	Normanton	H. Briggs and Son	T. Gallagher	20	Ditto	Fall of roof	–	1	–	–	–	1
48	June 23 12 p.m.	6th	Carlton Main	Barnsley	Carlton Main Coal Co.	E. Hancock	24	Ditto	Fall of coal; died July 1st	–	1	–	–	–	1
49	June 28 1.30 p.m.	7th	Kippax	Leeds	Kippax Sand Co.	C. Fern	38	Labourer	Injured by waggon; died 30th	–	–	–	–	1	1
50	June 30 7.45 a.m.	2nd	Roundwood	Wakefield	Roundwood Coal Co.	W. Dodson	15	Driver	Injured by tub	–	–	–	–	1	1
									Total—June	–	4	–	–	2	6
51	July 4 12.3 p.m.	7th	Combs	Dewsbury	E. T. Ingham	139 persons	—	-	Gas	139	–	–	–	–	139
52	July 11 9.30 a.m.	4th	Strafford	Barnsley	Strafford Coal Co.	G. Senior	65	Sceeenman	Injured by waggons	–	–	–	–	1	1
									Total—July	139	–	–	–	1	140

List of Accidents—*continued.*

No. of Accident.	Date and Hour of the Accident.	Hour of the Person's Shift, i.e., No. of Hours he had been at Work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost: Explosions of Firedamp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.	Total.
	1893.														
53	Aug. 7 11.0 a.m.	4th	Snowgate Head	Huddersfield -	Tinker Bros. - -	B. Battye -	20	Collier -	Fall of stone; died 8th - -	–	1	–	–	–	1
54	Aug. 18 2.0 p.m.		Warren House	Rotherham -	J. Brown and Co. -	T. Stodart J. Walsh B. Robinson	26 40 40	Sinker - Ditto - Ditto -	Fell out of "trunk" in sinking shaft	–	–	3	–	–	3
									Total—August -	–	1	3	–	–	4
55	Sept. 30 9.30 a.m.	4th	Sunny Bank -	Halifax -	Sunny Bank Coal Co. -	A. Collins -	20	Collier -	Fall of roof - - -	–	1	–	–	–	1
									Total—September -	–	1	–	–	–	1
56	Oct. 4 8.45 a.m.	2nd	Queensbury -	Bradford -	J. Briggs & Sons - -	G. Stephenson W. Jones	21 19	Ditto - Ditto -	Fall of stone - - -	–	2	–	–	–	2
57	Oct. 5 8.0 p.m.	6th	Snydale - -	Pontefract -	Rhodes and Dalby -	J. Gleed -	25	Byworkman	Crushed by tubs; died Nov. 12th -	–	–	–	1	–	1
									Total—October -	–	2	–	1	–	3
58	Nov. 1 12.30p.m.	7th	Wood - -	Huddersfield -	Tinker Bros. - -	C. Haigh -	30	Deputy -	Gunpowder; died 2nd - -	–	–	–	1	–	1
59	Nov. 3 9.10 a.m.	3rd	Westgate Common.	Wakefield -	T. Thresh & Son - -	A. Falkner -	25	Collier -	Fall of stone; died 17th - -	–	1	–	–	–	1
60	Nov. 15 6.50 a.m.	1st	Greasbro' -	Rotherham -	Greasbro' Coal Co. -	E. Bailey -	23	Ditto -	Fall of roof - - -	–	1	–	–	–	1
61	Nov. 20 12.50p.m.	7th	Tankersley -	Sheffield -	Newton Chambers -	A. Beaumont -	—	Engineman	By machinery - - -	–	–	–	–	1	1
62	Nov. 29 9.0 a.m.	3rd	Glass Houghten	Castleford -	T. H. Thorp - -	B. Guy - -	50	Collier -	Fall of roof - - - -	–	1	–	–	–	1
									Total—November -	–	3	–	1	1	5

List of Accidents—*continued.*

No. of Accident.	Date and Hour of the Accident.	Hour of the Person's Shift, i.e., No. of Hours he had been at Work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	Lives lost. Explosions of Firedamp.	Falls of Roof and Sides.	In Shafts.	Miscellaneous Underground.	Above Ground.	Total.
	1893.														
63	Dec. 12 2.0 p.m.	1st	Nunnery	Sheffield	Nunnery Coal Co.	G. Fogg	42	Labourer	By machinery; died 13th	–	–	–	–	1	1
64	Dec. 13 7.0 a.m.	1st	Low Moor	Bradford	Low Moor Iron Works	J. White	41	Collier	Fell out of cage	–	–	1	–	–	1
65	Dec. 15 1.0 p.m.	8th	Snydale	Pontefract	Rhodes and Dally	J. Nash	25	Ditto	Fall of coal	–	1	–	–	–	1
66	Dec. 18 1.40 a.m.	6th	Manvers Main	Rotherham	Manvers Main Coal Co.	T. Sherwin	66	Banksman	Fell down shaft	–	–	1	–	–	1
67	Dec. 20 4.0 a.m.	6th	Nunnery	Sheffield	Nunnery Coal Co.	J. O'Brian	46	Dataller	Fall of stone	–	1	–	–	–	1
68	Dec. 20 11.30a.m.	6th	Tinsley Park	Ditto	Tinsley Coal Co.	D. Shaw	29	Pump-man	Fell down pumping shaft	–	–	1	–	–	1
									Total—December	–	2	3	–	1	6
									Total	142	37	9	12	12	212
69, 70, 71, 72, 73, 74	On private branch railways and tramways and in washing and coking coal									–	–	–	–	6	6
									Gross Total	142	37	9	12	18	218

LIST of the FATAL ACCIDENTS, and DEATHS arising therefrom, within one YEAR and a DAY from the DATE of the ACCIDENT, of PERSONS EMPLOYED on PRIVATE BRANCH RAILWAYS AND TRAMWAYS, and in washing and coking COAL on PREMISES adjacent to or belonging to the MINES, in MR. WARDELL'S DISTRICT, comprising YORKSHIRE AND LINCOLNSHIRE, during the Year 1893.

No. of Accident.	Date and Hour of the Accident.	Hour of the Person's Shift, *i.e.*, No. of Hours he had been at Work when the Accident happened to him.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Persons killed.	Reputed Age.	Occupation.	Cause of Accident, and Remarks.	No. of Lives lost above Ground.
1	1893. Jan. 6 2.30 p.m.	9th	Garforth -	Leeds -	Garforth Coal Co.	J. Walker	54	Shunter	Injured by prop	1
2	April 13 4.0 p.m.	2nd	Whitwood	Normanton	H. Briggs & Son	J. Parry	16	Hurrier	Injured by tubs	1
3	April 22 10.15 a.m.	5th	Orgreave	Rotherham	Rotherham Vale Coal Co.	L. Needham	21	Shunter	Injured by waggons	1
4	July 22	Not at work.	Greasbro'	Ditto	Greasbro' Coal Co.	R. Prescott	52	Platelayer	Fell off loading stage; died 24th	1
5	Aug. 24 12.0 p.m.	6th	Wombwell Main	Barnsley	Wombwell Main Coal Co.	J. Black	40	Labourer	Ditto	1
6	Dec. 13 11.0 a.m.	5th	Whitwood	Normanton	H. Briggs & Son	J. Walsham	71	Platelayer	Run over; died 24th	1
									Total	6

(E.)

BOARD for EXAMINATION for the Mining District of YORKSHIRE and LINCOLNSHIRE.

5, PICCADILLY, BRADFORD, YORKSHIRE,
189

SIR,

I AM directed by the Chairman of the Board for Examinations for this District to inform you that the Secretary of State has been pleased to order the next examination of candidates for certificates of competency within the district to be held in the town of Leeds, in the County of York, on the day of next, and that such examination will be held accordingly, at on that day, commencing at 10 o'clock in the morning.

It will be necessary for you to present yourself punctually at the appointed hour.

The following gentlemen have been appointed examiners :—

T. W. EMBLETON, Esq., Mining Engineer.

THOMAS CARRINGTON, Esq., Mining Engineer.

WILLIAM EVANS, Esq., Manager of Mines.

It is impossible to fix beforehand the length of time which the examination may occupy, but it is not probable that your attendance will be required for more than days.

The subjects fixed for examination of candidates for *first-class* certificates are the following :—

1. Arithmetic :—The first four rules ; Vulgar fractions and decimal fractions ; Extraction of square and cube roots.
2. Ventilation :—Common air and gases ; different methods of ventilation.
3. The use of instruments for surveying and dialling and levelling (dialling by both fast and loose needle), and the testing of instruments for surveying. Plotting surveys and making plans and sections.
4. The winning and working of Coal Mines.
5. Practical Mechanics.
6. The Coal Mines Regulation Act, 1887, and the Special Rules in force in this district.

The subjects fixed for examination of candidates for *second-class* certificates are the following :—

1. Reading and writing.
2. Arithmetic :—The first four rules.
3. Ventilation :—Common air and gases ; different methods of ventilation.
4. The use of the anemometer, barometer, thermometer, and water gauge.
5. The Coal Mines Regulation Act, 1887, and the Special Rules in force in this district.

Under the Coal Mines Regulation Act, 1887, no person will be entitled to a certificate (in either class) unless he shall have had practical experience in a mine for at least five years.

A period of apprenticeship to a mining engineer cannot be substituted as an alternative for an equivalent period of regular employment in a mine under the Act unless the apprentice has in the discharge of his duties to go down mines and obtain practical experience therein.

It will be necessary for you to send to me, on or before the day of next—

1. Your authorisation from the Secretary of State to appear for examination. (The fee payable for this authorisation is £ , which should be remitted to the Under Secretary of State, Home Office, Whitehall, by means of a Post Office Order on the General Post Office, London, payable to C. J. Kynvett, Esq.)

2. The prescribed evidence as to character, consisting of—

(*a*.) A statement of your age, and of the situations you have filled during the last five years, to which a declaration must be appended that all the allegations are true, such declaration being signed by you in the presence of one witness.

(*b*.) A testimonial from a clergyman, or other minister of religion, or a magistrate, as to your sobriety and general good conduct, and a testimonial from your employer as to your sobriety, experience, ability, and general good conduct.

No person under the age of 23 years is eligible.

I am, Sir,
Your obedient Servant,
JOHN R. JEFFERY,
Secretary.

Mr. ______________________

Mr. Wardell's Report.

REPORT on the WORKING of the METALLIFEROUS MINES REGULATION ACTS in the YORKSHIRE and LINCOLNSHIRE DISTRICT, during the Year 1893. By FRANK N. WARDELL, Esq., F.G.S.

SIR, Wath, March 1894.

I HAVE the honour to submit to you my Report, as an Inspector of Metalliferous Mines, for the year 1893.

The working of the Acts in this district appears to me to be satisfactory.

I am thankful to be able to record that no fatality occurred at any of these mines.

There is an increase in the amount of mineral produced of 12,694 tons, the total quantities in 1892 and 1893 being 47,327 tons and 60,021 tons respectively.

The number of persons employed in the production of these minerals was 875 in 1893. In the previous year the total was 755. An increase is, therefore, shown here of 120 persons.

Two persons below the age of 16 were employed underground, and three under 13 years old above ground.

Exclusive of these, there were 63 persons under the age of 18 engaged above ground, or 15 more than in the preceding year.

No females were employed.

I append a table which shows the amount of mineral raised, the number of persons employed, and the proportion of tons produced per person employed in each year from and including 1880.

Year.	Mineral raised.	Persons employed.	Proportion of tons produced per person employed.
1880 - -	52,857 $\frac{6}{20}$	1,126	46·9
1881 - -	39,580 $\frac{14}{20}$	807	49
1882 - -	44,397 $\frac{3}{20}$	835	53·1
1883 - -	87,230 $\frac{11}{20}$	1,088	80
1884 - -	63,421	971	65
1885 - -	39,172 $\frac{16}{20}$	715	54·7
1886 - -	62,686 $\frac{5}{20}$	975	64·3
1887 - -	80,808 $\frac{10}{20}$	1,102	73·9
1888 - -	89,091	970	91·8
1889 - -	64,793	830	78·1
1890 - -	53,398	720	74·1
1891 - -	57,649	894	64·5
1892 - -	47,327	755	62·6
1893 - -	60,021	875	68·8

No circumstances have occurred which call for any special observation in this report.

I have, &c.,
FRANK N. WARDELL.

The Right Hon. H. H. Asquith, Q.C., M.P.,
Her Majesty's Principal Secretary of State.

MINES CLASSED UNDER THE METALLIFEROUS MINES REGULATION ACT.

SUMMARY of Persons employed in and about the Mines, and Quantity of Mining Produce, in Yorkshire and Lincolnshire, for the Year 1893.

Owner.	Mine.	Underground. Male Persons. Ages 12 to 13.	Underground. Male Persons. Ages 13 to 16.	Underground. Male Persons. Ages above 16.	Underground. Male Persons. Total.	Above ground. Ages 10 to 13. Males.	Above ground. Ages 10 to 13. Females.	Above ground. Ages 13 to 18. Males.	Above ground. Ages 13 to 18. Females.	Above ground. Ages above 18. Females.	Above ground. Ages above 18. Males.	Above ground. Total.	Total underground and above ground.	Kind of Mineral.	Mineral dressed. Statute Tons.	Undressed Mineral sold, treated, or used (exclusive of that which has been stocked or from which Mineral has been dressed). Statute Tons.
Midgley Brothers	Slead	—	—	—	—	—	—	—	—	—	—	—	—	Freestone	2,250	—
Bentley and Smith	Castlefields	—	—	—	—	—	—	—	—	—	—	—	—	"	—	8,910
J. and J. Haley	Hills	—	—	—	—	—	—	—	—	—	—	—	—	"	312	—
T. Wilkinson	Guyscliffe	—	—	—	—	—	—	—	—	—	—	—	—	"	1,000	—
R. Marsden	Blue Ball	—	—	—	—	—	—	—	—	—	—	—	—	"	60	—
E. S. Vint & Co.	Summerfield	—	—	—	—	—	—	—	—	—	—	—	—	"	380	—
Bentley and Kaye	Longroyde	—	—	—	—	—	—	—	—	—	—	—	—	"	6,200	1,300
J. Sunderland	Lillands	—	—	—	—	—	—	—	—	—	—	—	—	"	1,070	—
Saville Holmes	New Road	—	—	—	—	—	—	—	—	—	—	—	—	"	420	—
W. Thwaites	Slaters	—	—	—	—	—	—	—	—	—	—	—	—	"	1,000	—
S. Marshall	Raynor Road	—	—	—	—	—	—	—	—	—	—	—	—	"	2,000	3,000
T. Collins and Sons	Yew Tree	—	—	—	—	—	—	—	—	—	—	—	—	"	4,000	500
R. Roper	Jubilee	—	—	—	—	—	—	—	—	—	—	—	—	"	700	—
J. Brooke and Sons	Park	—	—	—	—	—	—	—	—	—	—	—	—	"	—	3,000
R. Fouldes	Near Croft	—	—	—	—	—	—	—	—	—	—	—	—	"	—	1,015
J. Roper and Sons	Lightcliffe Road	—	—	—	—	—	—	—	—	—	—	—	—	"	1,210	96
R. Roper	Legrams	—	—	—	—	—	—	—	—	—	—	—	—	"	900	—
Cookson and Ellis	Holton Hill	—	—	—	—	—	—	—	—	—	—	—	—	"	1,200	—
P. Normington & Co.	Blue Ball	—	—	—	—	—	—	—	—	—	—	—	—	"	900	250
G. Vint and Brothers	Idle	—	—	—	—	—	—	—	—	—	—	—	—	"	1,300	350
S. Cliffe & Son	Lightcliffe Road	—	—	—	—	—	—	—	—	—	—	—	—	"	1,080	—
Do. do.	Lane Head	—	—	—	—	—	—	—	—	—	—	—	—	"	1,724	—
G. Crossley & Co.	Fall Top	—	—	—	—	—	—	—	—	—	—	—	—	"	2,320	—
Scotgate Ash Stone Company	Scotgate Ash	—	—	—	—	—	—	—	—	—	—	—	—	"	5,507	—
John Kay	Far Park	—	—	—	—	—	—	—	—	—	—	—	—	"	300	—
D. and C. Roper	Guide Moor	—	—	—	—	—	—	—	—	—	—	—	—	"	850	110
R. Kershaw	Park	—	—	—	—	—	—	—	—	—	—	—	—	"	700	500
Jonas Stott	Moorhouse	—	—	—	—	—	—	—	—	—	—	—	—	"	500	750
Blackburn & Co.	Upper Lane	—	—	—	—	—	—	—	—	—	—	—	—	"	1,440	—
															39,323	19,781

Persons employed in and about the Mines, &c.—*continued.*

Owner.	Mine.	Underground. Male Persons. Ages 12 to 13.	Underground. Male Persons. Ages 13 to 16.	Underground. Male Persons. Ages above 16.	Underground. Male Persons. Total.	Above ground. Ages 10 to 13. Males.	Above ground. Ages 10 to 13. Females.	Above ground. Ages 13 to 18. Males.	Above ground. Ages 13 to 18. Females.	Above ground. Ages above 18. Females.	Above ground. Ages above 18. Males.	Above ground. Total.	Total underground and above ground.	Kind of Mineral.	Mineral Dressed. Statute Tons.	Undressed Mineral sold, treated, or used (exclusive of that which has been stocked or from which Mineral has been dressed). Statute Tons.
Burnaby and Hutchinson	Stoney Groves	—	—	—	—	—	—	—	—	—	—	—	—	Lead	—	—
Reed and Williams	Blackhill	—	—	—	—	—	—	—	—	—	—	—	—	”	—	—
Hutchinson and Williams	Cockhill and Sunnyside	—	—	—	—	—	—	—	—	—	—	—	—	”	—	—
Gill Head Mining Company	Gill Head	—	—	—	—	—	—	—	—	—	—	—	—	”	3½	—
York	Appletreewick	—	—	—	—	—	—	—	—	—	—	—	—	”	18	—
Blayshaw Gill Mining Company	Blayshaw Gill	—	—	—	—	—	—	—	—	—	—	—	—	”	—	—
J. Cradock	Linby	—	—	—	—	—	—	—	—	—	—	—	—	”	140	—
Ditto	Lolly Scarr	—	—	—	—	—	—	—	—	—	—	—	—	”	496	—
P. W. Spencer	Raygill	—	—	—	—	—	—	—	—	—	—	—	—	Barytes	260	—
														Total Lead	657½	—
														” Barytes	260	—
														{	39,323 19,781	19,781
														” Stone	59,104	—
	Total	—	2	319	321	3	—	63	—	—	488	554	875	Total	60,021½	—

Reports of Assistant Inspectors.

SIR, Outwood, Wakefield, 27th March 1894.

I HAVE the honour to report to you that during the past year I have exercised the duties of Inspector of Mines in the district comprising Yorkshire and Lincolnshire, and that in so doing I have acted as assistant to and under the direction of Mr. F. N. Wardell, the Chief Inspector.

I am, &c.

(Signed) JAMES MELLORS.

The Right Honourable H. H. Asquith, Q.C., M.P.,
Her Majesty's Principal Secretary of State,
Home Department, Whitehall.

SIR, Leeds, March 1894.

I HAVE the honour to report that during the part of past year I have exercised the duties of Inspector of Mines in the district of Yorkshire and Lincolnshire, and that in so doing I have acted as assistant to and under the direction of Mr. Frank N. Wardell, the Chief Inspector.

I have, &c.

(Signed) J. R. ROBINSON WILSON.

The Right Honourable H. H. Asquith, Q.C., M.P.,
Her Majesty's Principal Secretary of State,
Home Department, Whitehall.

MINES.

REPORT

BY

JOHN GERRARD, Esq.,
H.M. INSPECTOR OF MINES

FOR THE

MANCHESTER AND IRELAND DISTRICT (No. 6),

TO

HER MAJESTY'S SECRETARY OF STATE,

UNDER

The Coal Mines Regulation Act, 1887,
the Metalliferous Mines Regulation Acts, 1872 and 1875,
and the Slate Mines (Gunpowder) Act, 1882;

For the Year 1893.

Presented to both Houses of Parliament by Command of Her Majesty.

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Mr. John Gerrard's Report.

REPORT on the INSPECTION of Coal and Metalliferous Mines in the MANCHESTER and IRELAND DISTRICT, for the Year 1893.—By JOHN GERRARD, Esq.

SIR, Worsley, Manchester, March 1894.

I HAVE the honour to present my Report for the year ending 31st December 1893. The following indicate the contents :—

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1.—PERSONS EMPLOYED.

In the North and East Lancashire coal mines there were employed underground 32,826 persons; in 1892 there were 32,959, a decrease of 133 persons.

Above-ground there were 5,965 persons employed; in 1892 there were 6,140, a decrease of 175 persons.

Above and below ground there were 38,791 persons employed; in 1892 there were 39,099, a decrease of 308 persons.

Employed on private branch railways and tramways, in washing and coking coal on premises adjacent to or belonging to the mines, there were 835 persons; a decrease of 161 persons compared with 1892.

In the coal mines of Ireland there were employed underground 631 persons; in 1892 there were 635, a decrease of 4 persons. Above-ground there were 216 persons; in 1892 there were 203, an increase of 13 persons.

Above and below ground there were 847 persons, an increase of 9 compared with 1892.

In the metalliferous mines of North and East Lancashire (excluding the detached part of North Lancashire) there were employed underground 203 persons, above-ground 326; in 1892 there were 212 persons below ground and 262 above-ground.

In the metalliferous mines of Ireland there were employed underground 426 persons; in 1892 there were 374, an increase of 52. Above-ground there were 213, an increase of 4 compared with 1892. Total above and below ground 639 persons. In 1892 there were 583, an increase of 56.

2.—MINERAL PRODUCTION.

In North and East Lancashire there were produced 7,603,755 tons of coal, a decrease of 2,840,299 tons. Of fireclay, 95,286 tons against 127,319 in 1892, a decrease of 32,033 tons. Of pyrites, 459 tons against 622 in 1892, a decrease of 163 tons.

The total mineral production under the Coal Mines Regulation Act being 7,699,500 tons against 10,571,995 tons in 1892, a decrease of 2,872,495 tons.

In North and East Lancashire under the Metalliferous Mines Regulation Acts there were raised 75,627 tons of stone and 775 tons of rock-salt.

In Ireland there were 105,678 tons of coal raised against 111,881 tons in 1892, a decrease of 6,203 tons. Of fireclay, 3,500 tons against 3,943 tons in 1892, a decrease of 443 tons. A total production under the Coal Mines Regulation Act of 109,178 tons; a decrease of 6,646 tons.

Under the Metalliferous Mines Regulation Acts there were raised in Ireland 126,694 tons of minerals, a decrease of 1,432 tons compared with 1892.

The values of the minerals produced are—

Coal Mines Regulation Act.

North and East Lancashire.

—	1893.			1892.	
	Quantity.	Price per Ton.	Value.	Price per Ton.	Value.
	Tons.	s. d.	£	s. d.	£
Coal	7,603,755	7 9·89	2,974,701	7 6½	3,938,278
Fireclay	95,286	—	16,413	—	22,811
Pyrites	459	—	91	—	93
	7,699,500	—	2,991,205	—	3,961,182

Ireland.

—	1893.			1892.	
	Quantity.	Price per Ton.	Value.	Price per Ton.	Value.
	Tons.	s. d.	£	s. d.	£
Coal	105,678	8 10·17	46,750	8 11	49,999
Fireclay	3,500	—	612	—	690
	109,178	—	47,362	—	50,689

Metalliferous Mines Acts.

North and East Lancashire (exclusive of detached part).

(37,488 tons salt extracted from brine.)

Mineral.	1893.		1892.
	Quantity.	Value.	Value.
	Tons.	£	£
Rock-salt	775	193	425
Flags, stone, &c.	75,627	31,406	23,508
	76,402	31,599	—

Ireland.

Mineral.	1893.		1892.
	Quantity.	Value.	Value.
	Tons.	£	£
Alum clay (bauxite)	8,740	4,150	1,860
Barytes	4,934	2,609	4,965
Iron ore	67,292	11,532	11,625
Iron pyrites	3,568	2,035	2,160
Lead ore	59	206	352
Ochre	793	633	535
Rock-salt	41,308	8,509	8,613
	126,694	29,674	30,110

3.—ACCIDENTS SUMMARISED.

Under the Coal Mines Regulation Act, in North and East Lancashire there have been 54 lives lost in 50 accidents underground; above-ground at the mines two lives lost in two accidents, a total of 56 lives in 52 accidents. On private branch railways and in coke making, &c., three lives lost in three accidents. At and about the mines a total of 59 lives in 55 accidents.

In Ireland one life has been lost in one accident, which occurred underground.

Under the Metalliferous Mines Regulation Acts one life has been lost in one accident, that being underground and in East Lancashire. No accident in Ireland.

The following table gives the ratios of persons employed, quantity of mineral raised per accident, and per life lost, under the Coal Mines Act:—

—	Separate Fatal Accidents.	Lives Lost.	Persons employed under A. and B.*		Tons of Mineral wrought.		No. of Mines.
			Per Fatal Accident.	Per Life Lost.	Per Fatal Accident.	Per Life Lost.	
North and East Lancashire	25	56	745	694	148,067	137,492	280
Ireland	1	1	847	847	109,178†	109,178†	20

* A. and B.—At the mine, above and below, not including private railroads, &c.
† *In North and East Lancashire the output of minerals as above, was 234 tons per person employed underground, in Ireland it was 173 tons.*

The following table shows the ratios of deaths from accidents in and about the mines (including private branch railways, coal washing, coking, &c.), under the Coal Mines Act, per 1,000 persons employed, and per 1,000,000 tons of mineral raised, during the year 1893:—

—	Death-rate from Accidents per 1,000 Persons.							Death-rate from Accidents above and under Ground per 1,000,000 Tons of Mineral raised.
	Employed Underground.					Employed Above-ground from all Causes Above-ground.	Employed above and under Ground.	
	By Explosions of Fire-damp.	By Falls of Ground.	In Shafts.	Miscellaneous.	From all Causes Underground.			
North and East Lancashire	—	·792	·214	·640	1·646	·735	1·489	7·672
Ireland	—	1·584	—	—	1·584	—	1·180	9·159
Averages of the Kingdom	·291	·749	·187	·482	1·709	·900	1·552	6·043
Do. in 1892	·225	·791	·165	·464	1·645	·834	1·486	5·110

A list of all the fatal accidents is given at page 17. In addition to these fatal accidents, 116 serious accidents have been investigated; and 14 casualties, deaths and accidents not comprised within the Acts.

4.—GENERAL OBSERVATIONS, LABOUR SUSPENSION, &c.

The most prominent feature in connexion with coal mining during last year, was the long and disastrous labour suspension consequent upon the conflict that arose between the owners and their workmen as to wages.

The stoppage commenced on the 28th of July, and terminated on the 18th November.

The serious reduction in the output of 2,840,299 tons of coal in this district alone gives some indication of the disastrous effect of such a long stoppage. In the first half of the year the number of days worked at some of the largest collieries were 84, 99, 104, 108, 110, 116, 117, 121, 137; at the same places 43, 51, 50, 48, 51, 52, 54, 49, 54 days only were worked during the latter half of the year.

The value of the coal raised during the year, as published in the Mineral Statistics, was affected in several ways. In the first half of the year it diminished; in the latter half the value was raised very considerably, owing to the scarcity. Some owners had stocks which were disposed of at a higher rate; others supplied their customers at the old rates; many owners had no stocks at all. As an illustration, at one colliery the average value per ton in June was 6*s*. 7½*d*., whereas for the whole year it was 8*s*. 4·3*d*. Many inquiries were made, and I believe the figure published in the Mineral Statistics, 7*s*. 9·89*d*., fairly represents the average value per ton throughout the year.

COAL DUST.

At your direction I consulted some of the principal owners and mining engineers of the district with a view to selecting the best representative seams of coal from which to collect samples of coal dust, to be forwarded to Mr. Hall, H.M. Inspector of Mines, for experiment. The seams selected were Messrs. Fletcher and Burrow's Arley Mine; Messrs. Andrew Knowles and Sons, Trencherbone, from Clifton Hall Colliery; The Astley and Tyldesley Company's Crumbouke Mine; and Messrs. Platt's Great Mine from Moston Colliery. These owners readily consented to collect the dust. This involved a considhrable amouut of labour during many days. Mr. Saint and Mr. Grundy were present at the collection, and every pains taken to fairly collect the dust from the sides and roof alongside the roads. Representatives of the above firms were enabled by Mr. Hall to see the experiments. If opportunity should again occur, it is very desirable that from the Crumbouke and Great Mine Seams dust containing a greater amount of coal than was the case in that experimented on should be tested. Also that dust from the Mountain Mine Seam should be experimented on. It is largely worked in this district. Mr. Macalpine, of the Altham Colliery (where a disastrous explosion occurred), was willing that this should be done; indeed made every preparation to do so.

LOCKING OF SAFETY LAMPS.

At most of the large collieries where safety lamps are used they are locked by means of the lead plug. At some (about 15 large collieries, however) the lamps are locked by either a simple screw or by a common padlock. Both stand condemned, because they offer temptation to the men to open, there being no means of detecting if any have been opened. Several prosecutions of workmen have had to be made, being found with their lamps open, the lock being either screw or padlock. I have pointed out to most of these owners the desirability of changing the system of locking, and trust it may speedily be effected.

5.—EXPLOSIONS OF FIRE-DAMP.

No life has been lost from this cause.

Two non-fatal explosions have occurred, one in Lancashire, the other in Ireland.

In Lancashire, at the Shakerley Colliery, Tyldesley, on the 21st November, 4.30 a.m., John Hadfield, 26, fireman, was lighting a fuze to a powder shot; the burning fuze lit a small quantity of fire-damp, the explosion of which burned Hadfield severely. An examination of the place showed clearly that it had been filled with flame; there were the usual charring indications on the props and deposits of coked coal dust. Fortunately there was not a great amount of fire-damp, and outside the working place little coal dust. From the statement Hadfield made after complete recovery, it is certain that he examined with his lamp the face on each side of the stall, but did not examine the holing above the seam of coal near the shot. The holing was 3 feet 7 inches beyond the coal, and 19 feet in length across the stall, the stall being being 15 yards wide. Within the holing, without doubt, there was a quantity of fire-damp. This accident proves the danger of using gunpowder, and of firing shots by powder fuze. Over and over again has the dependence upon the examination failed. Am glad to be able to say that the owners have now discontinued the use of gunpowder.

In Ireland, at the Clonbrock Colliery, Queen's County, on the 18th September, at 12 noon, Richard Kennedy, 19, trammer, whilst lifting his candle out of an empty tub, lit a small quantity of fire-damp near the roof. It was about 12 feet from the face; the gas had accumulated at the lip of the ripping, which was 31 inches above the coal. The ventilating boards were 13 feet back from this lip; they ought to have been nearer. Gas had been found before, and safety lamps ought to have been in use. I was very much astonished to find that it has been a common practice for the fireman to examine for gas by placing a candle at the end of a long stick, and poking it up to suspicious places. Truly a fire-trier.

6.—FALLS OF GROUND FROM ROOF AND SIDE.

These have caused 25 accidents, involving the loss of 25 lives, 20 of them being from falls of roof. This is less than in the previous year by six, but is far too many. Twelve were distinctly the result of want of care, 10 were associated with either clearly defined slips or pronounced breaks. The improvement brought about by colliery owners and managers in the ventilation and lighting of coal mines, and the use of explosives, has been so marked that one cannot but believe if increased attention were given to reducing the number of accidents from falls of ground, a like success would result. The exercise of close observation to detect the presence of slips, breaks, and weakness; followed by the careful securing of such, would lead to the prevention of many of these accidents. But beyond this, it is becoming more and more recognised that the principle of fixing a maximum distance for support to the roof is very much to be desired. At some collieries this is in operation by direction of the management. The varied nature of the roof and the conditions in the various seams, may render it difficult to lay down a fixed, cast iron, requirement; nevertheless the managers have or ought to have a full view of those conditions, and they could give specific directions to meet the requirements in the different seams or the working parts of those seams.

7.—IN SHAFTS.

Six fatalities occurred in shafts, one more than last year.

On the 26th January, at the No. 2 Pit, Duxbury Park Colliery, James Alker, 63, attendant to hauling and pumping engines, had been raised 75 yards from the King Coal Seam to a mouthing leading to the Six Feet seam in which was the pumping engine. He was alone in the cage, carried a lamp, a meat can, and a drink can. The hooker-on at the King Coal gave the signals. He stated that immediately after the cage had stopped, as he believed, at the Six Feet mouthing, he heard a noise in the shaft. The hooker-on at the bottom shouted that Alker had fallen down the shaft. It was surmised that deceased in stepping from the cage missed his footing, and fell between the end of the cage and the side of the shaft. There was a table or moveable scaffold at the Six Feet mouthing, which should have been pulled down into position to step on. This had not been pulled down. There were three guide rods to the cage, and being only 51 yards from the shaft top, there should not have been much vibration. With the cage stationary the space between the end of the cage was eight inches at one side and 11 on the other. The cage could be pushed a further distance of eight inches.

On the 7th February, at the Rowley Pit, Executors of Colonel Hargreaves, Edward Holding, hooker-on, had attached a full tub to the endless chain by which the tubs are raised up the shaft when the fork at one end of the tub caught his leather waist belt, and he was carried 14 yards up the shaft before the chain could be stopped. The under-manager signalled to stop and to be reversed, calling to Holding to hold on as well as he could. The chain was lowered about four yards, when Holding fell to the bottom. It appears that his belt hurting, he raised himself by one hand, and liberated his belt from the fork by the other hand, and that he then fell. Orders have been given to stop the chain whilst attaching the tubs when any arrive with the fork end towards the shaft.

On the 22nd June, at the Darcy Lever Coal Company's Victoria Pit, John Henry Lever, 19, blacksmith's striker, had been lowered along with the smith to the Four Feet mouthing. There was some confusion as to which side they should get out; the smith got out on one side, the striker on the opposite. Lever was called to turn back, but he turned round and stepped into the shaft, falling 70 yards. On the side deceased got out the fence rail had been removed by the hooker-on. On the side he should have got out there was a fence in position. Now there are swing gates provided on both sides so as to fence the shaft.

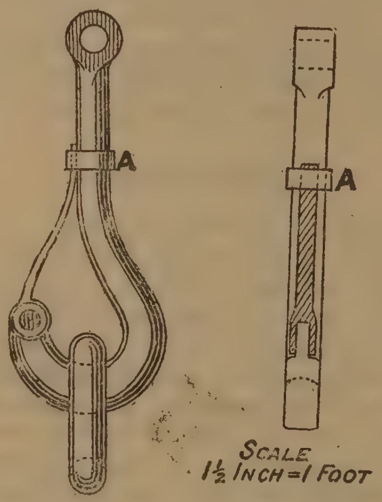
On the 29th July, at the Chisnall Hall Colliery, No. 1 Shaft, Edward Richard Walls, fireman, and Henry Heaton, attendant to a pumping engine, had been lowered in the hoppet to a point about 70 yards from the top. They had gone to examine a steam pipe; they were there several minutes, then signalled to be drawn to top. Joshua Wilson, 37, was in charge of the

engines. He started to raise them. Instead of stopping at the usual place at the top he raised them into the headgear. Ormerod's safety detaching hook came into operation all right, liberated the rope, and remained suspended in the bell. Unfortunately the link of the three hoppet chains left the "slip" hook below the detaching hook. The hoppet, with the two men, went down the shaft, a distance of 170 yards. Wilson had been on duty half an hour; had worked the engines several times during that time, letting men down and raising up. He had handled these engines two years, and was considered a careful and experienced man. His explanation of the accident was that the finger of the indicator to the engine stuck, and consequently led him astray as to the position of the load in the shaft. The man who had charge of the engines during the night and left them half an hour before the accident happened, stated that the indicator was then all right; that he had never known it to stick or go wrong before.

The distance the men had to be raised was 70 yards. Ordinarily they would be raised steady for 16 yards; they would be raised steady a like distance from the top, so that there was so short a distance between they should have been under careful handling the whole distance. The hoppet was raised to the headgear with such speed the cover above it was considerably dinted by colliding with the beam to which the detaching bell was fixed.

The general opinion was that the engineman made the mistake of thinking the men were being raised from a point farther down the shaft than they really were.

With that opinion I entirely concurred. It was also stated that the engineman may have tampered with the indicator after the accident. If he did, it availed him nought. As contributing to the accident it should be stated that the slip hook below the detaching hook, to which the link holding the three hoppet chains was attached, proved to be unsafe; such hooks ought not to be used. The sketch shows at A a sliding collar, when in position, holding the slip tongue and securing the link. This collar being free to move upward, in the accident did so, and let out the slip tongue, and thus the link passed from the hook, and left the hoppet free to fall down the shaft. Although its presence might not have prevented this accident, the absence of a warning bell to the indicator rendered the indicator an improper one. The advantage of a warning bell as an auxiliary to the finger of the indicator has been proved.



At the Birkacre Colliery on the 20th September, John Harrison, 19, sinker, was at work along with three others sinking the pit, when the "bogey" or tram upon which the hoppet was landed at the pit top fell down the shaft; all the men heard the noise of the approach and made to the side; deceased alone was struck by it. The sinking was a continuation of the drawing shaft, in which were wood-conducting guides to within 26 yards of the bottom, to a seam from which coal had been drawn. These guides, the management alleged, interfered with the providing of the ordinary sinking bridge. A single fall leaf to cover one half the shaft, was fixed, having a ledge to the front three inches higher than the rails on the leaf. The two banksmen had landed on the tram a hoppet three parts filled with dirt. They got hold of the hoppet to pull it and the tram from the fall leaf; the hoppet tilted over towards them. The weight being thus on one end of the tram, raised the other end. As the men pressed against the hoppet they caused the tram to move towards the shaft. The result was the tram shot from under the hoppet, mounted the ledge, and turned over into the shaft.

After the accident double fall leaves were fixed to completely cover the shaft top, and the height of the ledge was substantially raised. The single leaf had been in use for sinking the shaft at various periods for some years past, and this was the first time an accident had occurred. Nevertheless it was a very bad arrangement.

On the 3rd November, at the Mosley Common No. 2 sinking pit, James Vernon, sinker, was engaged along with others in walling the shaft, standing on the walling scaffold 20 feet from the bottom, when a hoppet containing bricks was lowered on to the scaffold, and struck down Vernon as he was walking across. It struck him on the back of the head, knocked him on his face, and rested on his legs. There were about four feet of slack rope. They had no warning of the approach of the hoppet. James Lomax, the engineman, frankly admitted he had made a mistake. He had made a mark on the indicator showing where the scaffold

was, but overlooked it. Lomax had been seven years in charge of the engines. The hoppet was lowered from the Rams Mine, 100 yards above the scaffold. A down signal fixed in the shaft, to be used by the banksman to warn those at the bottom of the approach of the hoppet, might have prevented this accident. Such down signals have been extensively used, but are not required by the Act or by the special rules of this district.

8.—EXPLOSIONS OF GUNPOWDER.

No life has been lost from this cause. Six accidents have occurred, causing serious injury.

On 29th March, at Hill Top, coal and fireclay mine, Thomas Walker, 30, collier, was getting over a tub, carrying in one hand a lighted candle and half a pound of loose powder. The two came together, and, as a consequence, the powder exploded.

On May 9th, at Ellerbeck Colliery, James Heaps, 40, shot lighter, having lit a shot and retired, heard a noise which he thought was caused by the explosion of the shot. He went back to the place and had hold of the fuze, feeling if it had run, when the shot exploded. Fortunately it was a small " pop " shot, in the bottom coal.

On July 5th, at Ladyshore Colliery, Edwin Seddon, 26, collier, was charging a hole with compressed bobbin gunpowder when it exploded, inflicting serious injury to Seddon and slight injury to James Settle, collier, who was close by. The hole was 32 inches deep, at the top of the seam of coal, it was intended to put 10 bobbins or $1\frac{1}{4}$ lbs. of gunpowder in the hole. Seddon had put five bobbins in, when they exploded. Both he and Settle stated positively a wood stemmer was being used. The most probable cause of ignition was undue pressure being used to get the bobbins home to the back of the hole. The hole was somewhat irregular, and, at the far end, had left the coal and was in a somewhat hard band above.

On the 14th of July, in No. 3 Pit, Preesal Salt Mines, Charles Bradshaw, 24, sinker, was charging a hole with gunpowder when the powder exploded, inflicting serious injury to eyes and face. It was said that he was using a wood stemmer; it may be so and that he was using undue force, or it may be he was using an iron stemmer. At the time of my visit they were using iron stemmers in the adjoining shaft, No. 4. They were not in rock-salt at the time.

On the 12th September, at Peel Hall Colliery, Joseph Coucil, 33, tunneller, was charging a hole with compressed bobbin gunpowder when it exploded, inflicting serious injury to eyes and face. The hole was in stone; it was drilled 14 inches by machine. A very hard band caused them to give up using the machine. Subsequently the hole was drilled by hand to a depth of 22 inches. Coucil dropped a bobbin ($\frac{1}{6}$ of a lb.) into the hole, dropped another one in, then began to use the wood stemmer, when immediately the powder exploded. This was stated by Coucil's companion. He was positive the wood stemmer was used. There was an irregularity in the hole where the change from machine to hand drill was made. It may be that one of the bobbins crossed in the hole, and in forcing them past the irregularity sufficient force was used to ignite the powder. Of course it was quite possible to fire the powder without the bobbin being crossed.

On December 22nd, at the Jarrow Colliery, Castlecomer, Ireland; E. Brennan Cate, 48, and James Campion, 50, colliers, were seriously injured whilst charging a hole with a cartridge containing fine gunpowder. The hole was drilled in the coal to a depth of 31 inches. Four inches from the front the hole passed through a lump of pyrites; 16 inches from the front a hard stone. Campion stated that they put the cartridge, $10\frac{1}{2}$ inches long by $1\frac{1}{8}$ inches diameter, into the hole. It was found to be tight and withdrawn. The hole was "rimed" out, and the cartridge again inserted. It met with an obstruction and would not go to the far end. They got the wood stemmer, a piece of ash tipped with a hard brass ring, put it in the hole, and used the hammer to drive it on the cartridge. After striking several blows, the powder exploded. A clear breach of General Rule 12 (*e*).

9.—SUFFOCATION BY GASES (BROAD OAK COLLIERY).

On January 31st another fatal out-burst of fire-damp and "minings" occurred at this colliery. On this occasion three lives were lost. About 10.40 a.m. five colliers were engaged at the face of a level place 12 yards wide; three were holing above the seam of coal, the other two were getting coal up. One of these latter, Job Rushworth, stated that he heard a cracking noise, apparently from the roof, which he thought was going to fall in, shouted to his mates "Come on," and then ran for his life. Left his lamp lit hung on a prop. After going four or five yards looked round and saw his lamp was extinguished, then he felt gas. The gas smelled strong. Only one of his mates got out, James Heap. The

others, James Henry Rees, John Ramsden, and James Cartwright, colliers, were killed. Took part in the recovery of the bodies. It was 12.30 noon when they got to the first. They had to put up brattice to remove the gas, and to fill out the small fine coal and "minings" which had been blown out. Altogether 72 tubs were filled with the blown-out minings, about 20 tons. Before the outburst occurred, from starting work at 6.30 a.m., the place "had been perfectly quiet, no cracking, there wasn't a 'muff.' "The minings were not 'wick.' None of us had the least idea of an approaching out-"burst. The only remark made was by John Ramsden, who said he thought the minings "looked blacker and shinier. They had taken one lift of 2 feet right across the place, and "had just started to hole for another 2 feet lift."

Robert Waddicor, under manager, said that he "passed through this place 25 minutes "before the outburst, he made a thorough examination. There was not the slightest sign "of an outburst being imminent. The place was absolutely quiet, not a single 'fizzer,' "not a rap or a crack, the minings were not working a bit. The three deceased were "found buried under blown-out minings, most of which being very fine small inferior coal. "They were close to the face, two were lying on their backs as though blown over, their feet "not more than six inches from the coal face; the third man was lying on his side with his "feet also near the face. No holes had been bored in this place, none bored since they got "the engine brow down."

At the inquest the jury returned a verdict of accidental death.

The accompanying plan shows the form the place was in. The red lined area in advance of the face represents the area disturbed. It contained small fine coal, &c., which was easily shovelled out, as though it had been crushed. The larger plan indicates where each of the many outbursts occurred, with the dates.

The facts connected with this last outburst appear to show that the minings within the disturbed area contained very little fireclay, almost entirely composed of coal, very friable, having black shining faces. All around the minings contained marked bands of very strong fireclay. It may be that the workmen had so thinned the enclosing clayey surrounding as to give vent to the pent-up gas, or possibly there was a subsidence of the roof, which caused the "bladder" to burst.

Soon after this sad fatality it was decided to bore holes again, and systematically in all the leading places to keep the holes 10 feet in advance of the face, and to have them bored by a drill 3¼ inches in diameter, bored by day wage men under the superintendence of an official.

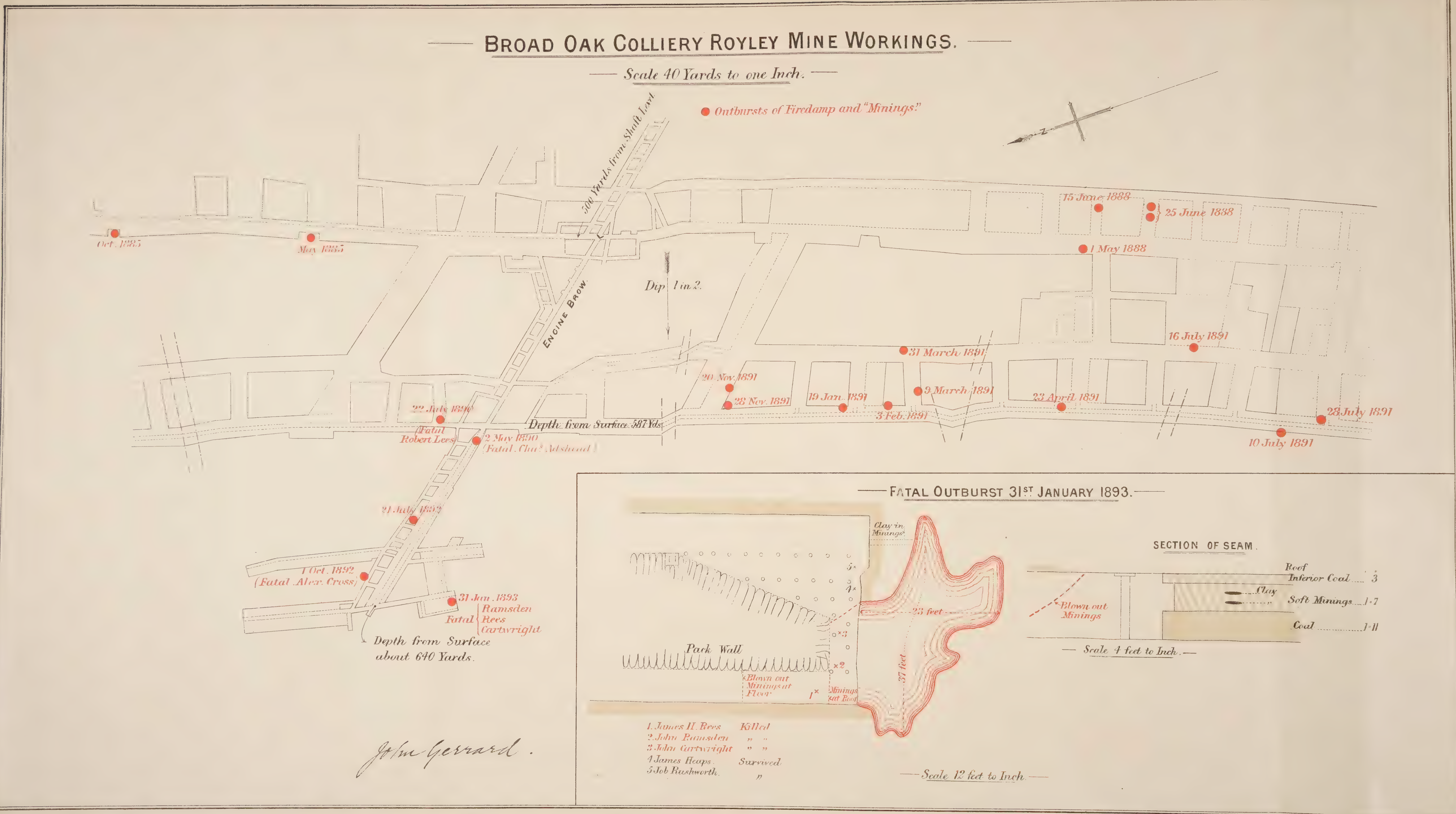
The officials have now a clear view of the importance of watching the changes in the nature and composition of the minings. If there be aught suspicious they at once put in a bore hole and instruct the men to work very cautiously. In addition to this they are trying to work out the coal in wide work. For a year now there has been no serious outburst.

10.—ACCIDENTS ON INCLINES, ENGINE PLANES, AND ROADS.

There has been a marked increase in the number of accidents under this head; 15 accidents, 16 lives lost. In the previous year 6 accidents, 6 lives.

Eleven were accompanied by carelessness, two of them being the result of a distinct breach of rules. Strict discipline is absolutely necessary. Under officials ought to report to the manager every breach of rule and direction coming to their knowledge. Leniency in dealing with these begets indifference and carelessness, with the inevitable consequence of an increased number of accidents.

Riding the men down and up the engine brows is extending in practice; the increasing length of the brows, the steep gradients, and the shortening of the hours, will make this more general. When so many as 50 persons ride together down a plane, a mile in length, having an inclination of one in three, it is absolutely necessary that the utmost watchfulness be observed in the care of the rope, the couplings of the tubs, and the conduct of the operation. There ought to be a daily careful examination of the ropes, attachments, and coupling chains. It is desirable that specially constructed trams be provided for the men to ride on, having double coupling chains of more than the ordinary coal tub strength, and provided with a guard chain. There should be a good substantial drag behind the train. Because the simple form of drag sometimes fails is not sufficient reason for dispensing with a drag; it should rather stimulate improvement in the form, until success is attained. In lowering men down the planes the drum should invariably be in connexion with the engines, so that if any failure of the break occur the engines are available to control the train. Further, the application of a



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powerful brake should not be impossible, under the control of one of the riders acting as a guard. The prevention of the running loose in case of rope breaking and the saving of one life in the whole life of the colliery would justify the provision.

11.—DEATHS NOT COMPRISED WITHIN THE ACTS.

January 16th, Wm. Andrews, 47, collier, died whilst at work in the No. 2 Bridgewater Pit. From natural causes.

January 23, William Bowden, 21, collier, died. He was slightly injured in the Brackley Pit on 27th May 1892, resumed work in September, and continued so up to 30th December when he was taken ill. The doctor certified that he died from pneumonia and there was no inquest.

January 27th, William Bullough, 35, dataller, died at the Scot Lane Colliery. A post-mortem was made, and at the inquest the doctor certified that he died from natural causes.

January 31, W. Beswick, 60, stone miner, died whilst at work in the Horncliffe Stone Mine. From natural causes.

February 28, Patrick Day died, having been injured on the 28th April 1890 at Wharton Hall Colliery.

March 6, John Molineux, 45, dataller, died in the Ellerbeck Colliery. From natural causes.

March 20, Charles Barton, 35, collier, died in the Withins Lane Colliery. From natural causes.

April 27, William Moult, 36, dataller, died at the Outwood Colliery from natural causes.

May 16, Evan Brierley, 38, drawer, died in the Chamber Lane Pit. From natural causes.

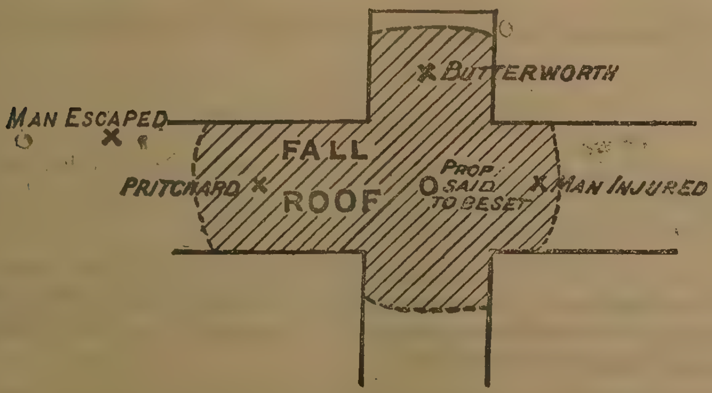
May 18, William Ramsden, 28, collier, died in the Spindlepoint Colliery. From natural causes.

June 5, William Turner, 39, steeplejack, fell from top of chimney at Shakerly Colliery. Accompanied by another steeplejack engaged in taking off the top of a chimney, some brick-work gave way and let down the coping stone on which he stood. Verdict, accidental death.

July 9, James Halliday, 46, collier, died in the Spindlepoint Colliery. From natural causes.

October 11, Richard Mansfield, 12, was trespassing in a brickyard, getting coal (during coal stoppage) from a thin seam outcrop. He had undermined a little, and was continuing so to do when a quantity of the overlying shale and coal fell on to him. Verdict, accidental death.

November 11, Sydney Butterworth, 43, and William Pritchard 38, two out of work colliers, were killed by fall of roof in an old working from the outcrop of a seam of coal at Longshaw, near Burnley. They were trespassing at the time.



The fall was 26 and 20 feet by 9 feet by 5 feet thick. One other man injured and one had a narrow escape. The accident was caused by neglect to secure the roof by timber. Verdict, accidental death.

November 20, Robert Horrocks, 73, collier, died whilst travelling to his working place in the Outward Colliery. From natural causes.

November 20, William Clegg, 66, collier, died in the Rowley Pit. From natural causes.

All the foregoing were inquired into, when underground the places inspected, and where an inquest held that attended.

12.—BOARD FOR EXAMINATIONS.

The Board in constitution continued the same throughout last year. Since, in January, owing to the lamented death of Mr. John Knowles, there is a vacancy. Mr. Knowles had most ably acted as chairman to the Board from its formation. So assiduous was he in attendance thereon I believe he had not missed a single meeting prior to his fatal illness.

Mr. T. Ratcliffe Ellis, solicitor, Wigan, continues to ably perform the duties of secretary to the Board.

Meetings of the Board were held at the Assize Courts, Manchester, on the 17th October, to fix the date of examination and to appoint Examiners. At the Owens College on the 21st December, when the Board inspected the arrangements for conducting the examinations; passed a vote of thanks to the principal and council of Owens College for the use of their rooms, and other business.

The dates upon which candidates attended for examination were the 21st, 22nd and 23rd December.

Seventy-four candidates were examined for first-class certificates, of whom eighteen passed:—H. A. Abbott, C. E. Arthur, J. G. Bell, J. H. Bennett, J. Brookes, M. Brown, J. Goodman, M. Heslop, E. Kenwright, W. Large, J. Livesey, W. Ivan Smith, H. Stephenson, T. S. Strick, W. A. Swallow, R. H. Urmson, R. G. Walters, F. W. Wright.

Ninety-seven candidates were examined for second-class certificates, of whom twenty-six passed:—T. Ashworth, H. Bailey, G. Bradshaw, T. H. Brierley, J. Broadhead, J. Cooper, P. Culshaw, R. H. Curry, W. Dempsey, T. Darbyshire, J. W. Evans, G. Fennell, J. Fletcher, W. Hancock, T. Hill, J. W. Hope, J. E. Ince, P. Lomax, W. T. Longfield, G. McDonald, J. McDonald, W. Pilkington, W. Platt, J. Stretton, E. Wardle, W. Wilkinson.

The examiners were:—Mr. David Arthur, Accrington; Mr. James Tonge, Bolton; Mr. George H. Hollingworth, Manchester.

By permission of the Board the questions submitted to the candidates are here given.

Coal Mines Regulation Act, 1887.

Board for Examinations for the Mining Districts of North and East Lancashire and Ireland.

Examination of Candidates for First-class Certificates of Competency, December 1893.

Instructions to Candidates.

1. During the examination the candidate must not speak to any other candidate, nor hold any communication with him, nor must he leave the room until he has completed his questions, nor then without the permission of the secretary.

2. Answers must be written on the paper supplied, and the answers must be numbered to correspond with the question. The candidate may answer any question in the order he may prefer. Answers must be written on one side of the paper only. Each sheet must be signed at the foot with the name of the candidate.

3. The paper of questions must be returned with the answers, and no candidate is allowed to take away with him a copy of the questions, or any of them.

4. Any candidate found using, or having in his possession in the examination room, a copy of the Official Abstract or Special Rules, will be disqualified.

Preliminary.

State your name, age, and address.

Questions.

I.—*Arithmetic.*

	Marks.
1. An oak beam is 15 feet 9 inches long, 15 inches broad, and 9 inches deep. Express its cubical contents in feet and decimals of a foot; and its cost at 2 shillings and 9 pence per cubic foot - - -	3
2. The area of a block of coal is 5,760 square yards. Express this area in acres, roods, perches, and yards, statute measure. What is the length in yards of the side of an equivalent square, and what weight of coal is there in the block; the coal being 3 feet 3 inches in thickness, and weighing 18 cwt. per cubic yard? - - - - - -	3
3. Express the weight in cwts., qrs., and lbs., of two steel boiler plates, each 13 feet 6 inches by 3 feet 9 inches, and $\frac{7}{16}$ inches thick; there being a circular manhole in one of them 15 inches in diameter, allowing 5 lbs. weight per square foot of $\frac{1}{8}$ inch thick - - - -	3
	9

II.—*Practical Mechanics.*

	Marks.
1. State where a boiler is most likely to give way from corrosion or other causes. How often should boilers be cleaned and examined? - -	6
2. What is the object of applying a condenser to a steam engine? What are its advantages? What is the amount of vacuum you would usually expect? Enumerate the different kinds of condensers you are acquainted with - - - - - - -	6
3. What is the effective horse power of an engine to haul a train of 12 full tubs up an incline 1,000 yards long, dipping 1 in 5, in 5 minutes; the tubs weighing each $3\frac{1}{2}$ cwt. when empty, and holding 7 cwts. of coal; and the rope weighs 22 cwt.; and allowing one-fiftieth for friction of tubs and rope? - - - - - - - -	6
4. What size of chain, or steel rope, would you require whilst sinking to carry a 14-inch set of pipes 80 yards in depth? - - - -	6
	24

III.—*Coal Mines Regulation Act,* 1887, *and Special Rules.*

	Marks.
1. State briefly the duties of a certificated manager under the Coal Mines Regulation Act of 1887 - - - - - -	4
2. What is the requisite qualification, under the Act, for a person to work alone at a coal face? - - - - - - -	4
3. State shortly the requirements of the Act in respect to working shafts and appliances in the shaft, so far as they affect the winding of coal and men	4
4. State briefly the rules in force as to the storage and use of explosives in a dry and dusty mine - - - - -	4
5. What are the instructions in the Special Rules of this district as to work persons in connection with places known to contain fire-damp? And what powers have the manager and other officials in case a work person breaks these rules? - - - - - - -	4
6. What are the duties of a surface inspector or head banksman under the Special Rules? - - - - - -	4
	24

IV.—*Practical Working of Collieries.*

	Marks.
1. Describe the different systems of coal working with which you are acquainted, and say under what conditions each system works best. Give a rough sketch of the system adopted at any mine with which you are acquainted, stating thickness of mine, quality of roof, floor, &c. - - -	6
2. Give your experience in taking out coal pillars. Describe how you protect yourself from falls of roof, illustrating by sketches - - -	6

	Marks.
3. Show by sketches and dimensions how you would secure a long-wall face. Define the relative positions of coal face, props, packs or chocks, and line of rails - - - - - - -	6
4. Describe the method of laying a bricking ring in a sinking pit, and of putting in a length of brickwork. Also the method of putting in a water ring. What precautions should be taken during these operations (*a*) if inflammable gas is given off; (*b*) if the sinking is in hard ground? -	6
5. What in your opinion is the best explosive now in use in coal mines? Give your reasons, stating its leading characteristics; mention any disadvantages; and say what are your views as to substitutes for explosives	6
6. There is a feeder of 300 gallons of water per minute at the bottom of a pit 250 yards deep. What arrangement of pumps would you adopt, and why? Give size and other particulars of pump required - - -	6
	36

V.—Mine Gases, Ventilation, &c.

1. Name the chief constituents of pure air, and give their chemical properties. Give the chemical properties of fire-damp and choke-damp, and their weights as compared with atmospheric air - - -	4
2. Say which, in your opinion, are the best mining lamps in general use at present; and define exactly the points in which each lamp you approve of excels the others - - - - - -	4
3. What are the chief points to be kept in view when constructing an air-way, with the object of passing a large volume of air with a minimum expenditure of power? - - - - - -	4
4. An a upcast and a downcast shaft are each 16 feet diameter; the former 190 yards, and the latter 200 yards deep; the air-ways in the mine are four in number, the frictional resistance in each being equal to that in an air-way 6 feet by 4 feet, and 1,000 yards long. What pressure should the water-gauge show in the upcast when 30,000 cubic feet of air is passing per minute? - - - - - - -	4
5. If a fan running at 80 revolutions per minute generates a current of 100,000 cubic feet of air per minute, with a water-gauge of 2·7 inches, what will be the horse-power of the air? If the quantity be increased to 140,000 feet per minute, what will be the water-gauge, the horse-power in the air, and the number of revolutions of the fan? - - -	4
6. Show how to ventilate the workings on the annexed plan - - -	4
	24
Oral Examination - - - - - - -	15
Total number of marks - - -	132

Two-thirds of the total number of marks to pass.

Coal Mines Regulation Act, 1887.

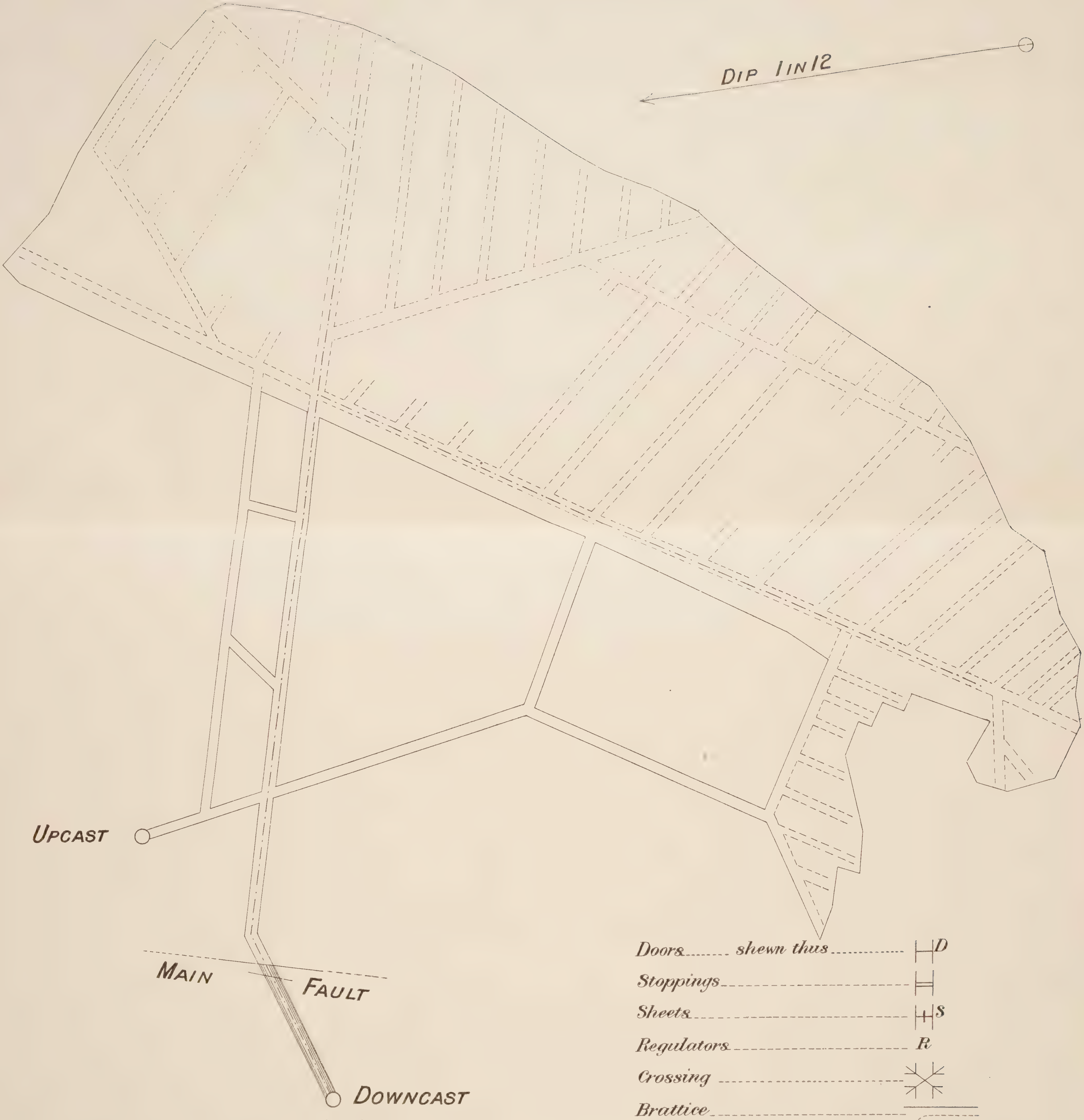
BOARD FOR EXAMINATIONS FOR THE MINING DISTRICTS OF NORTH AND EAST LANCASHIRE AND IRELAND.

EXAMINATION of CANDIDATES for SECOND CLASS CERTIFICATES of COMPETENCY, December, 1893.

Instructions to Candidates.

1. During the examination the candidate must not speak to any other candidate, nor hold any communication with him, nor must he leave the room until he has completed his questions, nor then without the permission of the secretary.

2. Answers must be written on the paper supplied, and the answers must be numbered to correspond with the question. The candidate may answer any question in the order he may



Doors ...... shewn thus .... D

Stoppings

Sheets .... S

Regulators .... R

Crossing

Brattice

Direction of Air current

Splits

Mine Gases, Lighting and Ventilation.

Show how to ventilate the workings on this plan.

To face the Examination Questions in

Mr. Gerrard's Report for 1893.

NOTE *The roads marked —.— are Main Haulage Roads.*

J. Gerrard.

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prefer. Answers must be written on one side of the paper only. Each sheet must be signed at the foot with the name of the candidate.

3. The paper of questions must be returned with the answers, and no candidate is allowed to take away with him a copy of the questions or any of them.

4. Any candidate found using, or having in his possession in the examination room, a copy of the Official Abstract or Special Rules will be disqualified.

Preliminary.

State your name, age, and address.

Questions.

I.—Arithmetic. — Marks.

1. From 10 tons 3 cwts. 1 qr. 19 lbs. take 3 tons 3 cwts. 3 qrs. 25 lbs., and reduce the remainder to lbs. - 3
2. Three colliers are paid for 76 tons of coal at 1*s.* $8\frac{1}{4}$*d.* per ton, and 12 yards at 3*s.* per yard. Out of the amount they pay 2 drawers each $4\frac{1}{2}$ days at 4*s.* 9*d.* per day. How much is left for each collier? - 3
3. In an airway 6 feet 3 inches high and 8 feet wide, what volume of air is passing when the velocity is 390 per minute? - 3
4. Add together 315*l.* 3*s.* 10*d.*, 27*l.* 9*s.* 6*d.*, and 43*l.* 12*s.* $7\frac{1}{2}$*d.*; subtract 35*l.* 12*s.* $1\frac{1}{2}$*d.*, and divide the remainder by 17 - 3

12

II.—Coal Mines Regulation Act, 1887, *and Special Rules.*

1. How would you carry out the Act in respect to fencing? - 4
2. What does the Act stipulate in order to secure safety whilst charging shot holes? And what precautions are to be taken after the shot is ready and before firing? - 4
3. What are the duties of the under manager as laid down in the Special Rules in respect to the following?— 4
    1. In the absence of the manager.
    2. As to inspections to be made by him.
    3. If any part of the pit be found unsafe.
    4. As to the daily report books.
4. What do the rules require a fireman to do if he finds fire-damp in a working place? (1) If he removes it. (2) If he does not remove it. (3) If it accumulates during the working - 4
5. What do the Special Rules require in respect to underground inclines? - 4
6. What is the duty of a fireman (*a*) when he finds the roof to be insecure, (*b*) when he finds a fall in the workings; and what else must be observed when he is making his daily inspection? - 4

24

III.—Practical Working of Mines.

1. Show how you would set timber in a drawing road— - 9
    (*a.*) With soft roof, and strong sides and floor.
    (*b.*) With good roof, and weak sides and floor.
    (*c.*) With weak roof and floor, and good sides.
2. State what, in your opinion, are the chief causes of accidents in downbrows, and say how you think they might be avoided - 9
3. If, in a shaft 300 yards deep, you found the brickwork to be dangerous and likely to fall out about halfway down, what would you do? - 9
4. How would you work a mine which is 5 feet thick, with a strong metal roof and little packing material, and dip about 1 in 3? Show by sketch the method of timbering the working places - 9

36

IV.—Mine Gases and Ventilation.	Marks.
1. State the general laws relating to the friction of air in mines - -	4
2. In a mine ventilated by three splits of air, how would you ascertain whether any split was passing more than its share of air? And if you found one split passing more than its share, how would you remedy the defect? -	4
3. If you suddenly found you had a higher side goaf filled with fire-damp, the goaf being 50 yards up, and 100 yards wide, with a drawing road on each side; describe, step by step, the course you would take to remove the gas, assuming you had sufficient air - - - - -	4
4. Which is the most likely part of a working place to find fire-damp accumulating? What is the most explosive mixture of fire-damp and air? What effect has fire-damp unmixed with air upon the flame in a lamp? -	4
5. Sketch a regulator, and state in what part of the workings you would fix it that it might be most effective, and state why. Sketch also an air crossing with dimensions for passing 30,000 cubic feet of air per minute over a main haulage road - - - - - -	4
6. Show how you would ventilate the workings in the annexed plan - -	4
	24
Oral Examination - - - - - - -	18
Total number of marks - - -	114

Two-thirds of the total number of marks to pass.

13.—INSPECTORS ASSISTING.

Mr. Wm. Saint continues to act, and Mr. James Grundy up to the 10th of November acted, as inspectors assisting. They have ably performed their duties. The greater number of the accidents have been fully investigated by them, attended at inquests, made a large number of general visits into the mines, and done much to ensure a due observance of the Mines Regulation Acts.

Mr. Grundy left on the 10th of November, at your direction, to serve under the Government in India.

Their reports are herewith appended.

Mr. G. B. Harrison commenced his duties during the absence of Mr. Grundy on the 1st of January this year.

In conclusion, I would observe that a number of complaints and intimations of danger have been received during the year. All have been fully investigated, and every care taken to maintain the confidential nature of the communications.

I have also to again thank those owners of mines having contributed to the accuracy of the published values of minerals, by furnishing information.

Lists of prosecutions, abandoned mines, fatal accidents, mines within the district, are appended hereto.

I have the honour to be,
Sir,
Your obedient servant,
JOHN GERRARD.

The Right Honourable
H. H. Asquith, Q.C., M.P.,
Her Majesty's Principal Secretary of State,
Home Office, Whitehall.

16.—LIST OF FATAL ACCIDENTS IN THE DISTRICT.

COAL MINES.—NORTH AND EAST LANCASHIRE.

LIST of the FATAL ACCIDENTS, and DEATHS arising therefrom within one YEAR and a DAY from the DATE of the ACCIDENT, in NORTH AND EAST LANCASHIRE during the year 1893.

No. of Accident.	Date.	Hour.	Hour of the Person's Shift.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Name of the Person killed.	Age.	Occupation.	Remarks upon cause of Death.	No. of Lives lost.
						BELOW GROUND.—50. (54 DEATHS.)					
						FALLS OF SIDE.					
1	Mar. 9	3.30 p.m.	10	Ashtonsfield - -	Little Hulton -	Bridgewater Trustees	James Robinson -	70	Collier - -	Piece of coal and clod (¼ cwt.) fell from face as he was holing, on to his leg and thigh. Died 12th August.	1
2	„ 30	2.30 p.m.	8	Martholme - -	Blackburn -	G. W. Macalpine -	George Noble -	34	„ - -	Piece of coal 9 inches by 6 inches by 3 inches burst from face; struck deceased on the breast whilst getting coal; an abscess formed. Died 7th June.	1
3	June 29	7 a.m.	1	Whittaker Bridge -	Radcliffe - -	Andrew Knowles and Sons, Limited.	Albert Holden -	30	„ - -	Fall of coal from face for want of sprag - -	1
4	July 6	6 p.m.	5	Stopes - -	Little Lever -	Thos. Fletcher & Sons	Jonathan Banks -	38	„ - -	Fall of coal from face; not sufficient sprags; two set 3 feet 10 inches apart in a holed length of 17 feet 3 inches.	1
5	„ 13	5.50 a.m.	8	Stoneclough - -	Manchester -	Stoneclough Coal Co.	Thomas Taylor -	44	Dataller - -	Fall of side; came from a fault. A proper inspection would have discovered the danger and caused it to be secured, either by pulling down or timbering.	1
						FALLS OF ROOF.					
6	Feb. 1	5.45 a.m.	1	Bridgewater No. 2 -	Worsley - -	Bridgewater Trustees	George Daniels -	37	Fireman -	Whilst examining the goaf of a working place he touched a prop which fell out, letting down on to him a quantity of roof, which broke his back. Died on 15th March.	1
7	June 6	8 a.m.	2	Mosley Common -	„ -	„ „	George Taylor -	27	Collier - -	Whilst setting a prop a quantity of roof fell on to him from between two slips. Prop ought to have been set sooner. Died 28th June.	1

LIST of the FATAL ACCIDENTS in NORTH and EAST LANCASHIRE—*continued.*

No. of Acci-dent.	Date.	Hour.	Hour of the Person's Shift.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Name of the Person killed.	Age.	Occupation.	Remarks upon cause of Death.	No. of Lives lost.
						FALLS OF ROOF—*continued.*					
8	June 16	9.30 a.m.	4	Ellesmere - -	Worsley -	Bridgewater Trustees	Joseph Cook -	25	Collier - -	Whilst building a pack in goaf 9 feet from face a large fall 6 yards square by 5 feet thick caught him. It came over a number of props. Probably from a weighting.	1
9	Dec. 1	7.10 a.m.	1	Wharton Hall - -	Tyldesley -	" "	James Morris -	21	" - -	Was preparing a footing for a prop when 6 feet long by 3 feet wide of roof coal fell on to him. Fell from between two clearly visible slips. The fireman had ordered two props to be put up.	1
10	Feb. 2	3.50 p.m.	10	Pendlebury - -	Pendlebury -	Andrew Knowles and Sons, Limited.	Robert Seddon -	33	Dataller - -	The deceased and another man were building a pack in a finished place; deceased knocked out a prop when a great quantity of roof fell on him. Fireman had told them not to knock out any more props until the pack was built up.	1
11	Apr. 10	1.30 p.m.	8	" - -	" -	" "	Henry Caddick -	25	Collier - -	Was putting a prop under a broken bar; sudden weight came on, bar broke; and let down a stone 3 feet square on to him.	1
12	Feb. 28	7 a.m.	1	Chanters - -	Tyldesley -	Fletcher, Burrows, & Co., Limited.	Robert Howcroft -	45	" - -	In drawing road near face, from between two well-known slips, quantity of roof fell on to him. Either a bar or props should have been under.	1
13	Mar. 8	7.45 a.m.	2	Stopes No. 3 - -	Little Lever -	Thos. Fletcher & Sons	Edwin Jones -	30	Dataller - -	A fireman had ordered him to try and get down some roof, because it was broken and sounded hollow. After trying some time to get it down the fireman ordered him to put a bar up, and left him. Whilst preparing to set the bar the roof fell, 5 feet 9 inches by 3 feet 3 inches by 4 to 8 inches thick.	1
14	May 11	2.40 p.m.	9	Outwood - -	Pilkington -	" "	John Matthews -	43	Collier - -	Coal from face had knocked out two props under broken roof. He was resetting one of these props when the roof fell on to him, 11 feet long by 3 feet 6 inches wide. The fall came from a well-known break.	1
15	" 20	3.20 p.m.	10	Tonge - -	Bolton -	Jethro Scowcroft -	Wilbraham Yates -	28	" - -	Fall of roof clod from breaks clearly to be seen before fall.	1
16	" 28	2 a.m.	5	Martholme - -	Blackburn -	G. W. Macalpine -	Richard Starkie -	52	Dataller - -	A stone 4 feet square, free on all sides, by being ripped up to and by slips, was resting on the pack. Deceased disturbed the pack and let down the stone on to him. The slips were clearly visible.	1

List of the Fatal Accidents in North and East Lancashire—*continued*.

No. of Accident.	Date.	Hour.	Hour of the Person's Shift.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Name of the Person killed.	Age.	Occupation.	Remarks upon cause of Death.	No. of Lives lost.
						Falls of Roof—*continued*.					
17	April 15	12.5 a.m.	5	Ellerbeck	Chorley	Ellerbeck Collieries, Limited.	James Heaton	50	Dataller	Deceased and another experienced dataller were sat eating their supper at a junction of a main level and jig brow. A sudden top weight came on, brought down an iron girder and two bars resting thereon. The height under bars 7 feet. Fall 12 feet long, 9 feet wide, 3 to 4 feet thick.	1
18	June 2	2 p.m.	8	Moston	Manchester	Platt Bros. & Co., Limited.	Wm. Llewellyn	51	Collier	Was removing a prop when small quantity of roof fell, fastening him. Before he could be released a further fall occurred, which killed him. The first fall came from a slip.	1
19	Aug. 7	1 p.m.	7	Peelwood	Tyldesley	Tyldesley Coal Co., Limited.	Wm. Hamblett	19	Dataller	Roof coal in roadway fell on to him, knocking him against a tub. Fireman was present, having doubts as to security; was preparing to set timber.	1
20	Sept. 11	10.30 a.m.	4	Gristlehurst	Birtle	Messrs. Pickford and Diggle.	William Turner	57	Collier and also fireman.	Piece of roof coal, 23 lbs. weight, fell on to the back of his neck, injuring spine. Died on 15th October.	1
21	Oct. 9	11 a.m.	6	Hole in Bank	Accrington	Geo. Hargreaves & Co.	John Towers	27	Collier	Taking a prop out in working place, the roof knocked heavy, and there was a pronounced slip visible. Two props were set to enable the one desired to be taken to be drawn safely; nevertheless the stone came down as he knocked the prop out.	1
22	Nov. 17	8.30 p.m.	7	Ladyshore	Little Lever	John Fletcher	John Kirkpatrick	48	"	Had removed two sprags. Began to get down overhanging top coals without re-setting sprags, roof coal and clod fell on to him.	1
23	" 23	3 p.m.	9	Newtown	Clifton	Clifton and Kersley Coal Co., Limited.	Charles Beckett	16	Waggoner	In working place quantity of roof fell from a pothole, bringing down a prop.	1
24	Dec. 8	7.30 a.m.	1	No. 2 Hewlett	Westhoughton	Wigan Coal and Iron Co., Limited.	Edward Simm	13	Driver	In drawing road whilst driving horse was caught by large fall of roof from slips, which ought to have been seen and guarded against.	1
25	" 16	10.30 a.m.	5	Broomstair	Haughton	Dukinfield Coal and Cannel Co., Limited.	Joseph Hague	42	Collier	Roof clod in working place fell; ought to have been pulled down.	1

LIST of the FATAL ACCIDENTS in NORTH and EAST LANCASHIRE—*continued.*

No. of Acci-dent.	Date.	Hour.	Hour of the Person's Shift.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Name of the Person killed.	Age.	Occupation.	Remarks upon cause of Death.	No. of Lives lost.
						IN SHAFTS.—6. (7 DEATHS.)					
						OVERWINDING.					
26	July 29	6.40 a.m.	1	Chisnall Hall - -	Coppull - -	Pearson and Knowles Coal and Iron Co., Limited.	Henry Richard Walls. Henry Heaton -	29 28	Fireman - Pumpman -	Sinking pit. Engineman made a mistake; thought they were being raised from shaft bottom, whereas they started 70 yards from pit top; overwound; safety hook detached, but hoppet hook uncoupled from the safety hook, and let hoppet and the men fall to the bottom of shaft, 170 yards.	2
						WHILST ASCENDING OR DESCENDING BY MACHINERY.					
27	Jan. 26	3.45 p.m.	10	Duxbury Park -	Chorley - -	DuxburyParkCollery Co., Limited.	James Alker -	63	Engineman -	Getting out of cage at mouthing missed his footing, and fell 200 yards to the bottom of shaft.	1
						THINGS FALLING FROM SURFACE.					
28	Sept. 20	4.15 a.m.	7	Birkacre - -	„ - -	Birkacre Coal Co. -	John Harrison -	19	Sinker - -	Whilst working at the bottom of the sinking pit the bogie or tram upon which the hoppet is landed at pit top fell down the shaft.	1
						FALLING FROM PART WAY DOWN.					
29	June 26	2.10 p.m.	9	Darcy Lever - -	Bolton - -	Darcy Lever Coal Co.	John Henry Lever	19	Blacksmith -	Whilst getting out of cage at mouthing part way down, stepped into the shaft.	1
						MISCELLANEOUS.					
30	Feb. 7	2 p.m.	8	Rowley - -	Burnley - -	Executors of Colonel Hargreaves.	Edward Holding -	27	Hooker-on -	Whilst attaching full tub to endless chain at bottom of shaft the fork of the tub caught in his belt; he was carried 10 yards up the shaft; signal given to lower, and immediately after commencing to lower he got loose and fell to shaft bottom. Died on the 8th.	1
31	Nov. 3	12.30 a.m.	8	Mosley Common -	Worsley -	Bridgewater Trustees	James Vernon -	52	Sinker - -	Crushed by hoppet of bricks lowered on to walling scaffold by engineman's mike.	1

LIST of the FATAL ACCIDENTS in NORTH and EAST LANCASHIRE—*continued.*

No. of Acci-dent.	Date.	Hour.	Hour of the Person's Shift.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Name of the Person killed.	Age.	Occupation.	Remarks upon cause of Death.	No. of Lives lost.
					MISCELLANEOUS UNDERGROUND.—19—22 DEATHS.						
					SUFFOCATION BY GASES.						
32	Jan. 31	10.45 a.m.	4	Nook - -	Ashton - -	Broad Oak Coal Co.	James Henry Rees John Ramsden - John Cartwright -	48 50 52	Collier - - " "	They had just commenced to holè in the "minings" above the seam of coal, when a great outburst of fire-damp and small coal, &c. came from the minings from the face, overpowered and buried them before they could get away.	1
					ON INCLINED AND ENGINE PLANES.						
33	Feb. 16	3.15 p.m.	11	Nook - -	" - -	Broad Oak Coal Co.	Joseph Lees -	42	Fireman -	Whilst riding up the engine brow on a special riding tram, along with a number of others, he raised his head, which came in contact with the roof, causing injury, from which he died on the 17th.	1
34	Mar. 8	9 a.m.	3	New Westhoughton-	Westhoughton -	Westhoughton Coal and Cannel Co. Limited.	William Massey Wood.	26	Ropeminder -	Whilst oiling an endless rope return pulley in motion his arm was carried by the rope round the wheel and torn off. He died on the 9th.	1
35	" 20	10.30 a.m.	7	Peel Hall - -	Little Hulton -	James Roscoe and Sons.	Robert Schofield -	17	Dataller - -	Crushed by tub being lowered down engine plane, loaded with rails and sleepers. Not being sufficiently scotched it overpowered and ran away. Deceased held on to the tub until it collided with other tubs at the bottom of plane.	1
36	May 8	12 noon	6	Arley - -	Atherton - -	Fletcher, Burrows, & Co., Limited.	John Dalton -	34	" - -	Crushed by tub whilst attempting to detach the coupling chain from endless rope.	1
37	" 8	7.45 a.m.	2	Tyldesley - -	Tyldesley -	Astley and Tyldesley Coal and Salt Co., Limited.	Isaiah Everett -	19	Drawer - -	Crushed by tub in spunney brow; prop came out whilst jigging; not sufficiently secured at roof; was let in the bottom. Father to deceased had fixed it. Accident occurred on 4th July 1892, died 8th May 1893.	1
38	July 17	11 a.m.	5	Hole House - -	Cliviger -	Cliviger Coal Co. -	James Cooper -	26	Jigger -	Crushed by tub; probably lifting a full tub; the endless chain being in motion.	1
39	" 25	7.30 a.m.	1	Bankhouse - -	Shaw - -	Oldham, Middleton, and Rochdal Coal Co., Limited.	James Morris -	39	Collier - -	Crushed against roof whilst riding in a tub on engine plane. His lamp had just been examined whilst moving; he had not adjusted himself, when his head caught a low part of the roof four yards from lamp station.	1

LIST of the FATAL ACCIDENTS in NORTH and EAST LANCASHIRE—*continued*.

No. of Accident.	Date.	Hour.	Hour of the Person's Shift.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Name of the Person killed.	Age.	Occupation.	Remarks upon cause of Death.	No. of Lives lost.
					ON INCLINED AND ENGINE PLANES—*continued*.						
40	Nov. 29	1.30 p.m.	7	Ladyshore	Little Lever	John Fletcher	William Waddington.	18	Jigger	Crushed by tub when jigging; as the empty tub approached him he failed to apply the break, and the tub ran on to him.	1
41	Dec. 14	6 a.m.	1	Pendleton	Pendleton	Andrew Knowles and Sons, Limited.	Richard Bromelow Joel Atkinson	66 48	Collier "	Crushed by tubs. Riding in ordinary coal tubs down engine brow, being lowered by break on drum disconnected from engine; break broke. Engineer could not control; speed increased until waggons left the rails and collided together.	2
42	" 22	4.30 p.m.	1	Pendlebury	Pendlebury	" "	Samuel Brennan	51	Fireman	Was riding in ordinary coal tub in train down engine brow. A tub left the rails; train stopped; deceased remained in his tub whilst another person was lifting the derailed tub on, when an empty tub ran into the one deceased was sitting in. The runaway tub was one of three which the taker-off at the top of the brow had carelessly pushed into the brow, thinking they were attached to the rope. Died on the 23rd.	1
					BY TRAMS AND TUBS.						
43	Mar. 10	7.30 a.m.	2	Ashtonsfield	Little Hulton	Bridgewater Trustees	Joseph Woodcock	24	Collier	Whilst lifting a tub on the rails injured spinal cord at the neck. Died on the 22nd.	1
44	June 6	4.30 p.m.	11	Brackley	Middle Hulton	" "	Joseph Heathcote	51	"	Crushed by tub. Three drawers took a full tub from the shunt outbye along the main level; two rode on it, the third running behind. The latter slipped, lost control of the tub which ran away, and caught deceased whilst walking out along the level. The drawers were prosecuted for breach of rules.	1
45	Mar. 20	8.30 a.m.	2	Allens Green	Radcliffe	A. Knowles and Sons, Limited.	James Jump	15	Driver	Was riding on the first tub. Owing to his driving too fast the tub left the rails and overturned on to him.	1
46	April 17	9.45 a.m.	4	Bank Hall	Barnley	Executors, Colonel Hargreaves.	Robert Berry	19	Jig tenter	Crushed by tub crossing from one endless chain road to another. Probably had not seen the tub. Ample room and light. Died 17th.	1
47	Dec. 21	10 a.m.	4	Manor	Kersley	Clifton and Kersley Coal Co., Limited.	Nathan Riley	35	Waggoner	Crushed by tub. Ran into by another waggoner whilst deceased was stopped in the level.	1

List of the Fatal Accidents in North and East Lancashire—*continued.*

No. of Acci-dent.	Date.	Hour.	Hour of the Person's Shift.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Name of the Person killed.	Age.	Occupation.	Remarks upon cause of Death.	No. of Lives lost.
						SUNDRIES UNDERGROUND.					
48	April 7	8 a.m.	2	Moston	Manchester	Platt Bros. & Co., Limited.	Rylance Richardson	48	Dataller	Whilst walking down a brow dipping 42° a prop rolled down and caught him, causing him to roll down the brow; broke collar bone and ribs. Died four hours after. Prop was knocked out of place by a tub leaving the rails.	1
49	June 23	10 a.m.	4	Manor	Kersley	Clifton and Kersley Coal Co., Limited.	Thomas Lord	58	Collier	Whilst moving some dirt from the floor cut his thumb; blood poisoning set in. Died 5th August.	1
50	July 21	6 a.m.	1	Brackley	Middle Hulton	Bridgewater Trustees	Thos. Entwistle	43	"	Knocked his head against a bar 4 feet from floor as he was walking in to his work; affected the brain. Accident 6th October 1892. Death 21st July 1893.	1
						ON SURFACE.—5.					
					On railways and tramways (including private railways adjacent to the mine).						
51	Mar. 29	4.30 p.m.	11	Moston	Manchester	Platt Bros. & Co., Limited.	Patrick Delahunty	59	Labourer	Whilst cleaning points knocked down by waggons being shunted. Engine whistled, persons shouted; all failed to warn him.	1
52	April 12	11.45 a.m.	5	Town Bent	Oswaldtwistle	Thos. Simpson & Co.	Patrick Dooley	50	"	Levelling ground slack in hopper. Another labourer warned him that he was about to open the bottom door. Deceased replied that he was all right; nevertheless when slack ran out he slipped and fell partly through opening, being suffocated.	1
53	June 22	3 p.m.	9	Atherton	Atherton	Fletcher, Burrows, & Co., Limited.	Samuel Brooks	71	Platelayer	On the 16th August 1892, whilst screwing up a fish plate bolt, he slipped and fell on the rail, hurting his side. Died 22nd June 1893.	1
						MISCELLANEOUS.					
54	Jan. 10	6.30 a.m.	1	Hagside	Radcliffe	A. Knowles and Sons, Limited.	Samuel Howcroft	38	Boiler stoker	Whilst cleaning out a boiler his hand struck against an iron barrow; a little skin was knocked off his knuckles; blood poisoning ensued. Died 16th February.	1
55	Feb. 9	7.30 a.m.	2	Yew Tree	Tyldesley	Tyldesley Coal Co., Limited.	Thomas Beswick	16	Carpenter's apprentice.	Cutting piece of wood with circular saw; the wood sprung up and struck him on the temple.	1

COAL MINES REGULATION ACT.

LIST of the FATAL ACCIDENTS and DEATHS arising therefrom in IRELAND, during the Year 1893.

No. of Accident.	Date.	Hour.	Hour of the Person's Shift.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Name of the Person killed.	Age.	Occupation.	Remarks upon cause of Death.	No. of Lives lost.
1	April 13	3 p.m.	8	Rock	Castlecomer	Joseph Dobbs	Richard Dowd	27	Collier	Getting stone to build pack in gate road 6 yards from face; stone fell from roof from slip clearly visible. Had thought stone was dangerous and was trying to work at one side of it. Died on 14th.	1

METALLIFEROUS MINES—NORTH and EAST LANCASHIRE.

No. of Accident.	Date.	Hour.	Hour of the Person's Shift.	Name of the Mine or Colliery.	Where situate.	Name of the Owner or Company.	Name of the Person killed.	Age.	Occupation.	Remarks upon cause of Death.	No. of Lives lost.
1	June 9	7.40 a.m.	1	Britannia	Bacup	Brooks and Brooks	Fielding Newell	45	Stone Miner	Fall of stone from face knocked him down, his back being injured either by stone or by falling. Ought to have had a sprag set. Died 8th August.	1

The following prosecutions have been reported during the year 1893, in accordance with section 66 of the Coal Mines Regulation Act, 1887:—

Date of Hearing.	Occupation of Offender.	Name of Owner of Colliery.	Nature of Offence, with Rules violated.	Amount.	
				Fine.	Costs.
Jan. 5	Engineman	The Earl of Bradford	Absent from engine-house whilst men were in the mine. General Rule 24.	10*s.*	10*s.*
Mar. 1	Drawer	Platt Bros. & Co., Limited.	Having a pipe in his possession. Special Rule 70.	1*l.*	12*s.*
" "	Dayman	Ditto	Having a pipe in his possession. Special Rule 70.	1*l.*	12*s.*
" "	Hooker-on	Ditto	Having matches in his possession. General Rule 10, Special Rule 70.	10*s.*	—
" "	Engine-tender	Ditto	Having matches in his possession. General Rule 10, Special Rule 70.	1*l.*	12*s.*
" 7	Machinery Inspector.	Blainscough Colliery Co., Limited.	Neglecting to examine the engines and other machinery. General Rule 5.	5*s.*	11*s.*
" 27	Collier	Thos. Fletcher & Sons	Unlocking safety lamp with a split nail. General Rule 10.	2*l.*	18*s.*
" "	Drawer	Ditto	Unlocking safety lamp with a split nail. General Rule 10.	2*l.*	18*s.*
" 30	Collier	Ditto	Unramming a missed shot. General Rule 12 (*e*).	2*l.*	18*s.*
April 18	Ditto	Blainscough Colliery Co., Limited.	Neglecting to set sprags. Special Rule 48.	5*s.*	11*s.*
May 11	12 Drawers	Clifton and Kersley Coal Co., Limited.	Being in a part of the mine they had no business to be in. Special Rule 44.	1*s.* each	6*s.* each
" "	Ditto	Ditto	Going beyond fence and interfering with ventilation. Special Rule 52.	1*s.* each	6*s.* each
June 26	Drawer	The Bridgewater Trustees.	Riding on a tub without permission. Special Rule 59.	5*s.*	10*s.*
	Ditto	Ditto	Ditto ditto	5*s.*	10*s.*
	Ditto	Ditto	Ditto ditto	5*s.*	10*s.*
July 12	Horse Driver	Broad Oak Colliery Co.	Riding up the engine-brow on the tram couplers. General Rule 36. Special Rules 147 and 152.	4*s.*	11*s.*
" 19	Drawer	Platt Bros. and Co., Limited.	Coming down incline in front of their tub. Special Rule 51.	2*s.* 6*d.*	5*s.* 6*d.*
" "	Ditto	Ditto	Ditto ditto	2*s.* 6*d.*	5*s.* 6*d.*
Aug. 3	Collier	Thos. Fletcher & Sons	Having matches in his possession. Special Rule 70.	10*s.*	15*s.*
Nov. 1	Banksman	Broad Oak Colliery Co.	Allowing unsecured rails to be taken in the same deck of the cage as a person riding. Special Rule 119.	—	6*s.* 6*d.*
Dec. 6	Collier	Ditto	Having matches in his possession. General Rule 10. Special Rule 70.	10*s.*	13*s.*
" 19	Ditto	Blainscough Colliery Co., Limited.	Neglecting to set sprags. Special Rule 48.	20*s.*	11*s.*
May 22	Drawer	Broad Oak Colliery Co.	Unlocking and relighting his own lamp at a lamp station, 17th May. Special Rule 64.	Made an apology and paid 5*s.* fine.	
June 20	Hooker-on	Ditto	Whilst passing under the descending cage he was crushed, 4th May. Special Rule 41.	Made an apology, and paid 2*s.* 6*d.* fine.	

Plans of Abandoned Mines.

Name of Mine.	Name of Owner.	Where situate.		Minerals worked, and, in the case of Coal, Name of Seam.	Date of Abandonment.
		Parish.	Post Town.		
Broadfield -	Thos. Simpson and Co.	Oswaldtwistle -	Accrington	Lower Mountain coal seam.	20 Aug. 1892.
Oakenclough	The Trustees of the late James Butterworth.	Rochdale - -	Bacup -	The "Mountain" or "Gannister" coal seam.	About the 15th May 1889.
Birkacre -	BirkacreCo.,Ltd.	Coppull - -	Chorley -	Yard coal seam - -	31 Dec. 1892.
Longworth -	Henry & Edward Deakin.	Bolton-le-Moors	Bolton - le-Moors.	The name of seam is uncertain, but is locally known as the "Little Mine." It is in the lower coal measures.	28 July 1892.
Brinsop Hall	Brinsop Hall Coal Co., Ltd.	Dean - -	Bolton -	King coal seam, No. 6 Pit.	11 Aug. 1892.
Do. -	Do. - -	Do. - -	Do. - -	Yard coal seam, No. 5 Pit.	" " "
Do. -	Do. - -	Do. - -	Do. -	Arley coal seam, No. 6 Pit.	" " "
Do. -	Do. - -	Do. - -	Do. - -	New Arley coal seam, No. 5 Pit.	" " "
Ogden -	Moses Horrocks Taylor & Lawrence Walmsley.	Rochdale - -	New Hey, Rochdale.	"Foot" or "Little" seam above Mountain mine.	15 Nov. "
Tonagh -	Monaghan Mining Co., Ltd.	Clontibret -	Castleblayney.	Lead ore - -	17 June 1893.
Lee - -	The Oldham, Middleton, and Rochdale Coal Co., Ltd.	Prestwich -cum-Oldham.	Oldham -	Royley coal seam -	Feb. 1885.
Withins Lane.	A. Knowles and Sons, Ltd.	Radcliffe - -	Manchester	Dow coal seam - -	16 Sept. 1893.
Do. -	Do. - -	Do. - -	Do. -	Five Quarters coal seam	" " "
Do. -	Do. - -	Do. - -	Do. -	Cannel or Hynes coal seam.	" " "
Coney Green	Do. - -	Do. - -	Do. -	Five Quarters coal seam	" " "
Do. -	Do. - -	Do. - -	Do. -	Cannel or Hynes coal seam.	" " "
Hagside -	Do. - -	Do. - -	Do. -	Ditto - -	" " "
New Line -	John Maden and Sons.	Rochdale - -	Bacup -	Sand Rock coal seam -	25 Oct. "

Kersal Bank, Higher Broughton, Manchester,
March 28, 1894.

Sir,

In accordance with the Metalliferous Mines Regulation Act, 1872, I have the honour to report that during the year 1893 I acted as an Inspector of Mines in the district of North and East Lancashire, and Ireland, under the direction of Mr. Gerrard, the Chief Inspector.

I also acted in the same district and under the same direction under the Coal Mines Regulation Act, 1887.

I have the honour to be,
Sir,
Your obedient Servant,
WILLIAM SAINT.

The Right Honourable
Herbert H. Asquith, Q.C., M.P., &c.,
Her Majesty's Secretary of State,
Home Office, Whitehall,
London, S.W.

27, Chowringhee Road, Calcutta.

Sir,

In accordance with the 20th section of the Metalliferous Mines Regulation Act, 1872, I have the honour to report that during the year 1893, up to the 10th November, I acted as an Inspector of Mines in the North and East Lancashire and Ireland district under the direction of Mr. Gerrard, the Chief Inspector.

I also acted in the same district and under the same direction under the Coal Mines Regulation Act, 1887.

I have the honour to be,
Sir,
Your obedient Servant,
JAMES GRUNDY.

The Right Honourable
Herbert H. Asquith, Q.C., M.P., &c.,
Her Majesty's Secretary of State,
Home Office, Whitehall,
London, S.W.

SECOND REPORT

OF THE

ROYAL COMMISSION

ON

EXPLOSIONS FROM COAL DUST IN MINES.

Presented to both Houses of Parliament by Command of Her Majesty.

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REPORT.

TO THE QUEEN'S MOST GRACIOUS MAJESTY.

We, Your Majesty's Commissioners, whose hands and seals are hereunto set, having been appointed by Your Majesty to inquire into the effect of coal-dust in originating or extending explosions in mines, whether by itself or in conjunction with fire-damp, and also to inquire whether there are any practicable means of preventing or mitigating any dangers that may arise from the presence of coal-dust in mines, do now most humbly submit to Your Majesty this our final report.

The Commission was appointed on February 9th, 1891.

The duty imposed upon it was entered upon without delay, and evidence was taken from March 13th to July 14th, 1891.

The proceedings were then adjourned, and the First Report, containing the evidence taken in 1891, was presented on July 30th, 1891.

In the following year the examination of witnesses was resumed from February 12th to April 8th, and again in 1894 further evidence was taken in regard to an explosion which had occurred in the New Pit, Camerton Colliery, near Radstock, on 13th November 1893.

Meanwhile Your Majesty's Commissioners considered that it would be desirable to have special experiments made in order to test the inflammability of different kinds of coal-dust, and after communicating with the Secretary of State for the Home Department, it was arranged that Mr. Henry Hall, Inspector of Mines for the Liverpool District, should undertake a series of coal-dust experiments to include dusts collected from the principal seams in the respective mining districts to be tested as to their inflammability in the same way as he had already done with certain Lancashire dusts in January 1893.

Accordingly, Mr. Hall obtained 52 samples from 45 collieries and from 36 separate seams, and these, with the exception of four or five samples, were fully tested at the White Moss Colliery, Skelmersdale, Ormskirk, in the months of May, June, and July, with the results that will be referred to later in the course of this Report.

During the course of the inquiry 39 witnesses have tendered evidence. Among them are included the Permanent Secretary of the Home Department, mining inspectors, colliery proprietors and managers, mining engineers, scientific authorities, and representatives of different institutions and associations connected with the mining industry. The views of the colliers were obtained from four of the officials of their Associations.

The chief coal-fields in Great Britain have been represented, namely, Durham (East and West), Lancashire, Yorkshire, Derbyshire, Staffordshire (North and South), South Wales and Monmouthshire, Somersetshire, the Forest of Dean, and the east and west of Scotland. Thus the Commission have collected evidence not only on the general question, but also on the special circumstances of every important district.

A great amount of evidence has been given with reference to the various experiments that have been made, and also with regard to many of the large explosions which have occurred in Great Britain.

During the course of the inquiry fatal explosions have occurred at the Sladderhill Pit, at Apedale, Staffordshire, on 2nd April 1891; at the Malago Vale Colliery, Bristol, on 31st August 1891; at the Park Slip Colliery, Tondu, on 26th August 1892; and at the New Pit, Camerton Colliery, near Radstock, on 13th November 1893. In each case the circumstances attending the disaster have been inquired into on the spot by members of the Commission, and a memorandum on these cases, by Professor Dixon, a member of this Commission, is appended to this Report.

Before further considering the evidence given, we beg leave to submit a brief account of the rise and progress of what has been called the coal-dust theory and of the facts by which it is alleged that the importance of coal-dust as an agent in the production and extension of explosions in mines has been conclusively established.

Early in the present century the effect of coal-dust in an explosion had been observed. In the report on an explosion at Wallsend Colliery on September 3, 1803, in which thirteen men and boys were killed, it is said that, "the workings were "very dry and dusty, and the survivors, who were the most distant from the point

"of explosion, were burnt by the shower of red-hot sparks of the ignited dust "which were driven along by the force of the explosion."

Although thus incidentally referred to, the subject does not seem to have received much attention till 1845, when the late Professor Faraday, in his report to the Home Secretary on the explosion at the Haswell Collieries in September 1844, said:—

"In considering the extent of the fire from the moment of the explosion it is not "to be supposed that fire-damp was its only fuel; the coal-dust swept by the rush "of wind and flame from the floor, roof, and walls of the works would instantly take "fire and burn if there were oxygen enough present in the air to support its com- "bustion; and we found the dust adhering to the faces of the pillars, props, and walls "in the direction of and on the side towards the explosion, increasing gradually to "a certain distance as we neared the place of ignition. This deposit was in some "parts half an inch, in others almost an inch thick; it adhered together in a friable "coked state. When examined with the glass it presented the fused round form of "burnt coal-dust, and when examined chemically and compared with the coal itself, "reduced to powder, was found deprived of the greater portion of the bitumen, "and in some instances entirely destitute of it. There is every reason to believe that "much coal gas was made from this dust in the very air itself of the mine, by the "flame of the fire-damp which raised and swept it along, and much of the carbon of "this dust remained unburnt only from want of air. At first we were greatly "embarrassed by the circumstance of the large number of deaths from choke-damp, "and in the evidence that *that* had been present in very considerable quantities "compared with the small proportion of fire-damp, which, in the opinion of those in "and about the works just before, must have occasioned the explosion. But, on "consideration of the character of the goaves and reservoirs for gaseous fuel, *and the* "*effect of dust in the mine*, we are satisfied that these circumstances fully account "for the apparent discrepancy."

And at a subsequent discussion at the Royal Institution, Mr. Faraday said:—

"The ignition and explosion of the (fire-damp) mixture would raise and then kindle "the coal-dust which is always pervading the passages, and these effects must in a "moment have made the part of the mine which was the scene of the calamity "glow like a furnace."

After this the danger appears to have been overlooked for 20 years, and the first attempt to deal with it by legislation was contained in the Mines Act of 1887.

Meanwhile the subject excited some attention in France, where in the year 1867 M. Verpilleux, as the result of experiments which he had been making, came to the conclusion that coal-dust was an important factor in coal-mine explosions. In 1875 M. Vital made some experiments in connexion with an explosion which had occurred in a part of the Campagnac Colliery, where the existence of fire-damp had never been demonstrated. He concluded that very fine coal-dust, rich in inflammable constituents, would increase the intensity of an explosion of fire-damp and prolong its extent.

Galloway, 982. 984. In 1870 Mr. W. Galloway began to make a special study of colliery explosions. As the result of his inquiries he came to the conclusion "that the usual attempted "explanation of explosions by supposing outbursts of gas to have taken place was "quite untenable, and that there must be some other cause which had not been yet discovered." While inspector of mines in Scotland he had investigated between 60 to 80 cases of fire-damp explosions, pure and simple, but on leaving Scotland and going to Wales he was struck by the fact that all the great explosions in Wales had occurred in dry and dusty mines, and that none of them had taken place in damp ones. At the same time he noted that the only great explosion that had taken place in Scotland up to that time had taken place in what was the only dry mine in Scotland known to him, namely, Nitshill Colliery. (Galloway, 990.)

Galloway, 991. Mr. Galloway thus came to the "conclusion that coal-dust was really the one "element that had been up to that time practically lost sight of."

In July 1875 he made his first experiments. He found that if coal-dust and air did not form an inflammable mixture, a small addition of fire-damp would certainly make it so, and also, that "a mixture of air and fire-damp which would not be "inflammable alone would become inflammable when coal-dust was added." (Galloway, 993, 994.)

Shortly afterwards, that is on 6th December in the same year, an explosion occurred in the Llan Colliery, South Wales. Mr. Galloway investigated the circumstances on the same day and reported that "coal-dust had undoubtedly played the most "important part in the explosion." (Galloway, 995.)

Galloway, 1001. Mr. Galloway proceeded to make further experiments and he communicated the results in a paper read to the Royal Society on the 2nd March 1876.

As the result of subsequent experiments and an examination into the circumstances attending the explosions at Pen-y-graig, Risca, and Seaham in 1880, he advanced a step further, and became convinced, "that fire-damp is altogether unnecessary for "the propagation of flame with explosive effects by a mixture of dry coal-dust and air."

This conclusion was also arrived at by Professor Marreco, who conducted some experiments in conjunction with Mr. W. Cochrane and Mr. Morison, the results of which were published in 1878. Transactions of North of England Institute of Mining and Mechanical Engineers, 1878–9, vol. xxviii. p. 85.

In 1880, experiments on a miniature scale were conducted by the Chesterfield and Derbyshire Institute of Engineers. The experimental chamber was 82 feet in length by 18 inches deep and 16 inches wide, and a pair of horse pistols. half-inch bore, was used to represent the flame from a blown-out shot. Out of 134 instances when coal-dust alone was tested ignition was obtained in 36 cases. In 46 experiments with dust and gas, ignition was obtained in 21 cases. In no instance—even in cases where 6 per cent. of gas was present—was anything that could be termed an explosion obtained; the only result was ignition without violence. Stokes, 2973. Stokes, 2977. Longden, 3406, 3463.

In June 1876, Mr. H. Hall, inspector of mines for the West Lancashire district, described, in a paper read before the North of England Institute of Mining Engineers, experiments made on a practical scale by himself and Mr. Clark, a mining engineer, at St. Helens, in an adit 45 yards long going from the surface at the crop of a coal seam. Coal dust was laid on the floor, and shots were fired at the face of the adit. Flame travelled the whole length of the adit. Mr. Hall says, "The blast "was very fierce, and would certainly have proved fatal to anyone struck by it in "its course." H. Hall, 185.

After the terrible explosion at Seaham, on September 8th, 1880, attention was again forcibly directed to the effect of coal-dust in a mine explosion. At the request of the Home Secretary, Sir Frederick Abel, a member of the Accidents in Mines Commission, experimented with the dust from this colliery. The experiments were principally made at Garswood Hall Colliery, near Wigan. These experiments established, in the words of the Accidents in Mines Commission, that "the proportion of fire-damp required "in a mine to bring dust readily into operation as an explosive material when "thickly suspended in the air, borders upon, and is even sometimes below, the smallest "amount (about 2 per cent.) which can be detected in the atmosphere of a mine "by the most practised observer with the use of the Davy lamp," and further, that "such dust particles need not be inflammable nor combustible to produce "the result named."

Sir F. Abel also made a further series of experiments to ascertain the distances to which, in the absence of dust, flame is projected from a blown-out shot, and also to learn to what extent the flame would be elongated if communicated to a cloud of coal-dust. The results showed that without dust the flame from a blown-out shot of 1½ lbs. of gunpowder only occasionally reached a distance of 20 feet, and even in a narrow gallery would not attain 35 feet. In the opinion of the Accidents in Mines Commission they also afforded "conclusive proof that in galleries or air-ways "approximating in their nature to those existing in coal mines, coal-dust, even "when sparsely suspended in the air, provided both are in a fairly dry condition, "will feed the flame projected by a blown-out shot so as to carry it on to a "comparatively considerable distance, and the particular results last referred to "demonstrated that, even with the limited dust-supply which it was possible to "suspend in the air, the flame not only extended to a distance of over 80 feet from "the seat of the blown-out shot (being projected into the open air beyond), but that "it also extended into a cross-working, and even in a direction opposed to the "natural air-current at the time."

In 1882, MM. Mallard and Le Chatelier, members of the French Fire-damp Commission, published the result of their inquiries. They rejected the theory that coal-dust was any serious danger, and maintained that no colliery explosion of any importance could be attributed with any probability to the action of coal-dust.

Between July and December 1884, a series of experiments on a large scale was made by the Prussian Fire-damp Commission at Saarbrücken. The experimenting chamber was built on the surface. It was 167 feet long; it was elliptical in shape, and had a sectional area of 17½ square feet. A side gallery, 33 feet in length, was afterwards added.

The conclusions drawn by Mr. Hilt, a member of the Prussian Commission, were submitted to the English Commission in the following terms :—

(1.) "The presence of coal-dust in more or less abundance in the immediate vicinity " of the working face gives rise to more or less considerable elongation of the flame " projected by a blown-out shot, whether small quantities of fire-damp be present in " the surrounding air or not.

(2.) *a.* "In the complete absence of fire-damp the elongation or propagation of flame " is generally of limited extent, however far the deposits of dust may extend in the " mineways.

* * * * *

(*b.*) "There are, however, certain descriptions of coal-dust which, if ignited by a " blown-out shot, will not only continue to carry on the flame, even to distances " extending considerably beyond the confines of the dust deposits, but will also give " rise to explosive phenomena or results, in the complete absence of any trace of " fire-damp, which in character and effects are similar to those produced with some " other dust in air containing 7 per cent. of fire-damp."

* * * * *

(3.) *a.* "All the phenomena produced by the burning of, and propagation of flame " by, coal-dust are intensified by the presence in the air of small proportions of fire- " damp, but such dusts as will *per se* only favour to a limited extent the propagation " of flame from a blown-out shot, give rise only to moderately increased volumes of " the flame, in the presence of even as much as 3 per cent. of gas, and are not at " all capable, under those conditions, of carrying on flame throughout the length of a " dust-strewn area: the latter result will, however, be produced, even with such dusts, " if the proportion of fire-damp in the air amounts to 4 per cent.

(*b.*) "Certain dusts which, under favourable conditions, appear to have the power of " propagating flame to an indefinite extent in a dust-laden area, the air being free " from fire-damp, will, if only sparsely suspended in air containing fire-damp in some " proportion below 3 per cent., render such a gas-mixture susceptible of explosion by " a blown-out shot.

(4.) "Special experiments, in which the branch gallery, described as opening into " the main gallery near its extremity, was charged with a fire-damp mixture (retained " by brattice cloth) demonstrated that a coal-dust ignition or explosion, developed in " the complete absence of fire-damp, can communicate ignition to an explosive gas- " mixture existing at a very considerable distance from the point of first ignition."

On March 15, 1886, the English Accidents in Mines Commission, which had been sitting since 1879, after exhaustively reviewing the history of the coal-dust question, and experiments made at home and abroad, reported :—

"It is conclusively established that—

"1. The occurrence of a blown-out shot in working places where very highly " inflammable coal-dust exists in great abundance may, even in the total absence of " fire-damp, possibly give rise to violent explosions, or at any rate be followed by the " propagation of flame through very considerable areas, and even by the communication " of flame to distant parts of the workings where explosive gas-mixtures, or dust- " deposits in association with non-explosive gas-mixtures, exist.

"2. The occurrence of a blown-out shot in localities where only small proportions of " fire-damp exist in the air, in the presence of even comparatively slightly inflammable, " or actually non-inflammable, but very fine, dry, and porous dusts, may give rise to " explosions, the flame from which may reach to distant localities where either gas " accumulations or deposits of inflammable coal-dust may be inflamed, and may " extend the disastrous results to other regions."

In 1890, between April 30th and October 20th, Mr. Henry Hall, Her Majesty's Inspector of Mines, made further experiments on an important scale in the shafts of mines with dusts from various Lancashire seams and mines. The results are tabulated in Appendix I.

Appendix I.

The first series, on April 30th and May 21st, was carried out in a disused pit shaft near Ormskirk, placed at Mr. Hall's disposal by the White Moss Colliery Company. The shaft was 50 yards deep and 7 feet in diameter. A cannon $2\frac{1}{2}$ feet long, with a bore of 2 inches, was placed at the bottom of the shaft pointing directly upwards. The air in the shaft was then saturated with fine coal-dust, which was thrown down from the top, and the cannon was then fired by electricity with the dust in suspension in the shaft. In all, six experiments were made, and in four of them explosions, of more or less violence, accompanied in three cases with a rush of flame into the air, were the result. It is worthy of note that the dust, which had failed to ignite in

one of the experiments, exploded with considerable violence when the cannon was fired two hours afterwards, no dust having been added in the meantime. The greatest distance traversed by the flame in these experiments was 65 yards, limited, of course, by the depth of the pit.

The second series of experiments was made on June 26th at the Southport Pit, lent for the purpose by Messrs. Rich, Evans & Co., Haydock. The depth of the pit is 130 yards, and the diameter is 18 feet. This pit was in course of sinking, and was connected with another sinking pit close by by means of a cut through in a coal seam at a depth of 100 yards. The cannon was fixed on a scaffold at the latter depth. The pit sides were very wet, and the lower part of the pit below the scaffold was full of water. A coke fire was placed on the scaffold, causing the experimental pit to act as an upcast. In this series of experiments no ignition of the dust was obtained after six attempts. Mr. Hall is disposed to attribute this to the wet condition of the shaft, and its large diameter, which prevented the heat given off by the gunpowder shots from being sufficiently confined to effect ignition.

The third series of experiments, on July 30th, and October 17th and 20th, 1890, proved to be by far the most important and conclusive, and were carried out at the Big Lady Pit, belonging to Messrs. Rich, Evans and Co. This pit is 210 yards deep and 8 feet diameter. A scaffold was fixed at a depth of 180 yards and two cannons side by side were attached to it. At this depth there was a small arched way leading to another pit (pumping shaft) 21 yards distant; this way was lined with bricks, and its sectional area was 10 feet. There was a similar arched way of larger dimensions at the bottom of the two pits.

The experimental shaft was upcast for the other, and the air passing up it was visibly charged with vapour from the water lodged below. The speed of the current was about 100 feet per minute, but this speed was much reduced when the air was charged with dust to the extent of reversing from time to time.

The ventilation went direct through the openings to the experimental shaft, and was quite free from fire-damp.

On the first day, five experiments resulted in three explosions, with the emission of flame in two cases 30 and 40 feet respectively above the pit top.

On the second day, out of six attempts, there were explosions in three cases, but only in one instance did flame proceed from the pit mouth.

The third day's experiments were seven in number. In four cases there was no ignition of the dust or unusual violence In two others the dust ignited (in one with considerable violence), but without the exhibition of flame. The seventh and last experiment is thus described by Mr. Hall:—

"Dust was ignited, followed by a continuous roar and a rush of flame completely "filling the pit mouth and ascending 60 feet into the air. This was the most violent "explosion since the commencement of the experiments. It is difficult for anyone "who did not witness this experiment to realise the extent of the explosion. The "flame continued to issue from the pit for five or six seconds, followed by dense "smoke. The violence carried away some of the wood work 37 feet above the pit "mouth. (Only *one* cannon was fired.)

"On four different occasions during these experiments in the Big Lady Pit the "flame travelled more than 200 yards, and only ceased when it reached the mouth "of the pit, and there was an undoubted increase of violence as it travelled on its "course."

In the three series the quantity of dust varied from 2 to 6 cwt. Gunpowder was used in each instance, with but one exception, and the charge varied from three-quarters of a pound to four pounds.

Mr. Hall is perfectly satisfied that there was no fire-damp in the shafts during these experiments, and the following is an analysis of the ventilation of the shaft taken during their progress:— H. Hall, 391.

Oxygen	20·56
Nitrogen	79·20
Carbon dioxide	0·15
Sulphur dioxide	0·09
	100·000

Mr. Hall sums up as follows:—

"These experiments conclusively prove that blasting with gunpowder in dry and "dusty mines may cause serious disasters *in the entire absence of fire-damp*. It is

"impossible to explain why many of the experiments failed to cause explosions or to "ignite the dust, but the fact that at intervals these did occur perfectly justifies the "above conclusion."

In 1885 an important Commission on explosions in mines was appointed in Austria. The sittings of this Commission lasted from 1885 to December 1890, and the final Report was published in 1891. A large number of experiments were conducted under their supervision. In all, 353 experiments were made with 345 kinds of dust, generally without any admixture of gas. These experiments showed that, without any admixture of fire-damp, nearly all kinds of coal-dust were ignited by a cartridge of 100 grammes of dynamite lying loose; while many notoriously dangerous dusts were less inflammable than other less dangerous dusts. It was further shown that a small admixture of fire-damp notably increased the danger and sensitiveness of the coal dust, so that a dust which is otherwise not dangerous may give rise to a disastrous explosion if there is a little fire-damp present. The fineness of the dust, as well as its dryness, greatly increased its sensitiveness and danger.

Appendix XIII.

The Coal-Dust Theory.

We have now brought the history of the question down to the time of the appointment of the present Commission, and we proceed to describe the theory of coal-dust agency in explosions, based on the facts and inferences above stated, which have been presented to us by the witnesses favourable to it.

It may be summarised as follows:—

I. The circumstances of many explosions, and especially of explosions on a very large scale, and covering a great length of the workings, cannot be fully explained by reference to fire-damp or gas alone.

II. The presence of coal-dust, and especially of fine dust, may be the sole cause of an explosion.

III. If the coal-dust is in sufficient quantities it will certainly extend the effect and increase the intensity of an explosion caused by any other means.

IV. Fire-damp in small quantities—so small as not to be dangerous *per se*—may be highly dangerous in the presence of coal-dust.

We proceed to consider these propositions seriatim.

I.

The presence of Gas alone is insufficient to explain many Explosions.

In support of this allegation attention is called to features which observation has shown to be common to wide-spreading explosions:—

Lushington, 17. W. N. Atkinson, 2119.

(*a.*) The distances traversed by some of these explosions are enormous. In the case of Seaham this amounted to 4 miles, and as fire-damp does not render the atmosphere explosive unless it constitutes at least five per cent., it is difficult to say whence a sufficient quantity could come to carry the explosion for the whole of this distance. Unless there were a constant escape of gas all along the roads traversed by the explosion, the first escape, or blower, would be clearly insufficient to account for the whole explosion.

J. B. Atkinson, 612. W. N. Atkinson, 2120, 2155.

(*b.*) There is a general absence of indications of alarm on the part of the workmen. If gas had come off in the shape of a sudden blower big enough to cause such wide-spreading explosions, it would, it is said, have been perceived before the explosion occurred, and there would have been signs to this effect.

W. N. Atkinson, 2188.

(*c.*) The force of the explosion is invariably towards the goaves—never from them. The goaves are the spaces from which the coal has been removed and are likely receptacles for gas. If gas from the goaves had been the chief agent in these explosions, the indications of violence would be *from* the goaves and towards the intake air-way.

Lushington, 14. W. N. Atkinson, 2190.

(*d.*) No trace of any outburst of gas is to be discovered after the explosion. "It is "purely an assumption, entirely assumed, that there has been such an outburst, not "from any evidence that is found afterwards; but from the fact that there has been "an explosion, and a source must be found for the gas."

Lushington, 19, 29, 63. W. N. Atkinson, 2198.

(*e.*) It is pointed out that when a gas explosion takes place, it must in its limits be dependent upon the amount of gas, and its explosive force, whereas it is a curious feature common to most of the large explosions that the explosion has extended to the downcast shaft. If gas be the agent in such cases, the advocates of the coal-dust

theory urge that it is a remarkable coincidence that the length of the road and the extent of the explosion should be identical.

(*f.*) In many cases the explosion traverses a certain road, but where the road divides the explosion follows only one branch, and leaves the other untouched. The air entering the divided roads must have the same composition as the air in the single road which feeds them, and therefore if the air in the single road contains sufficient gas to be explosive, the explosion should traverse the two roads equally. It is contended that the course of the explosion depends upon the presence or absence of inflammable coal-dust. Moreover, the explosions are chiefly confined to the intake air-roads, which are practically free from gas, but which are usually the most dusty roads in the mine. The explosion frequently spares the return air-roads, which carry off all the gas which is made in the pit, but which are comparatively free from dust; and it avoids horse-roads, where the dust is usually impure, and damp roads, where the dust is laid by the water.

Lushington, 30, 63A. J. B. Atkinson, 589, 604. W. N. Atkinson, 2135, 2187.

(*g.*) In these explosions no great violence is exhibited for about 60 to 90 yards on each side of the shot supposed to have caused the explosion. "If it had been a gas "explosion, force would have been exhibited at once, at any rate, much quicker."

J. B. Atkinson, 701. Forman, 5076.

(*h.*) Many of the explosions have occurred in mines worked with naked lights at the time of the disaster. It is highly improbable that any pit under these circumstances would become in such a state from gas as to allow an explosion sweeping the whole length of the mine.

J. B. Atkinson, 601.

It is contended that these facts are unintelligible on the theory that gas alone is the agent of the explosion, but are entirely consistent with the hypothesis that the explosion is largely due to, if not entirely caused by, the presence and ignition of coal-dust.

W. N. Atkinson, 2163.

It is further contended that:—

(*a.*) All the gigantic explosions have occurred in dry and dusty mines. Mr. W. N. Atkinson says:—"I have never been able to find an authenticated case of a large "explosion occurring under circumstances in which coal-dust may not have been the "chief agent."

Lushington, 57. W. N. Atkinson, 2097.

(*b.*) The force is greatest where the dust is purest and finest.

Lushington, 33.

(*c.*) The explosions are frequently coincident with the firing of shots in main intake air-ways, where shots are rarely fired, in which gas is impossible except in the smallest quantities, but which contain the most inflammable dust in the mine.

J. B. Atkinson, 593. W. N. Atkinson, 2160.

II.

Coal-Dust alone, without any admixture of Fire-damp, can, when ignited, produce a dangerous Explosion.

The explosion may be originated by a blown-out shot, and, according to some witnesses, even by a light or torch such as are in use in the mine, or by open fires.

There is, however, only one case known in Great Britain where an explosion of coal-dust is alleged to have taken place with an ordinary light as the inciting cause, although it is said that such instances on a small scale are on record in France. The exceptional case was that of an accident at the Brancepeth Pit on April 24th 1889, by which three men lost their lives. The colliery was idle at the time, and the opportunity was taken to clear out a coal hopper which is used to store coal for the use of the coke oven. Six men were clearing out the fine dust adhering to the sides, and had hung open lights near the bottom of the hopper. Almost as soon as they commenced shovelling the dust down an explosion took place, burning all of them severely. There is, however, some difference of opinion as to the circumstances of this accident.

J. B. Atkinson, 665, 769. Galloway, 1076. W. N. Atkinson, 2216. Lushington, 43A.

On the one hand it is maintained that it was a real explosion of coal-dust alone, as there was sufficient force to blow off the iron roof and to kill three men; and that no gas was present, because an open torch was used at the top of the hopper a few minutes before the dust was thrown down and ignited, and because the roof and windows were not sufficiently tight to prevent the escape of gas if it had been present.

H. Hall, 228. J. B. Atkinson, 663. Bell, 1526, 1592.

On the other hand it is said that gas must have been present.

Dickinson, 1267.

Other witnesses regard the accident as an *ignition* or *inflammation* of the dust and not an explosion. They say that it did not burst out the windows but merely cracked them, and that a comparatively slight force would raise the one corrugated sheet that was blown from the top of the hopper.

Thomas, 6206. Lishman, 2725, 2737. Weeks, 3132–3152.

That there is practically no danger in the use of naked lights in mines, so far as dust is concerned, if the entire absence of fire-damp could be guaranteed, is the opinion of most of the witnesses who have been examined on the point.

Weeks, 3191. Burrows, 4070. Lucas, 3302. Garforth, 3348, 3857.

H. Hall, 225, 481. J. B. Atkinson, 774, 883, 915. Galloway, 1136, 1562. Bell, 1532, 1553, 1588, 1592, 1597. W. N. Atkinson, 2217. W. F. Hall, 3534, 3578, 3630. Robson, 4440, 4569. Hood, 5928, 6034, Thomas, 6210, 6221, 6265.

It is pointed out by several witnesses that accidents have taken place on the surface owing to coal-dust coming into contact with a naked light, but it is generally admitted that it would be "very improbable," and only by a "remote possibility," that coal-dust, even when raised in the shape of a dense cloud, would explode at a naked light. The flame, or fire, must go with considerable force in amongst the fine dust to cause an explosion, and this condition is not present when a naked light is the only source of ignition.

H. Hall, 230. Stokes, 3041, 3049.

In none of the experiments hitherto undertaken has a mixture of coal-dust and air been ignited by the light of a candle or a miner's lamp. The gas-jet flame in the Chesterfield experiments failed to ignite such a mixture, and confirmed the Prussian experiments on this point. Mr. H. Hall also, in the shaft experiments, introduced a torch lamp into the mixture, and there was no effect except that sparks extended three or four feet from the flame.

Lushington, 38, 39.

In connexion with this branch of the subject we must, however, call attention to the evidence laid before the Commission as to explosions of other combustible dusts, such as flour-dust, ground cork, &c., which appear in all cases to have been initiated by a naked light.

Abel, 2441–2443.

As Sir Frederick Abel says, such explosions are purely dust explosions.

"I suppose that in all the cases of explosions of flour-dust it is impossible that there "should have been the presence of any other inflammable gas than that caused by the "flour-dust itself?—Certainly."

"These explosions are undoubtedly pure explosions of dust?—Yes, pure dust "explosions."

"And that would of itself lead to the conclusion that under exceptionally favourable "circumstances coal-dust might also be explosive without the presence of gas?—"Certainly."

Richards, 3933, 3965.

Mr. Richards, after experimenting with flour-dust, rice-dust, and other combustible dusts, has arrived at the conclusion that the dust of any combustible substance will explode if diffused in proper proportions in atmospheric air and brought into contact with a light.

On a consideration of all the facts and arguments produced, it appears to Your Majesty's Commissioners that while it may be just possible, under very exceptional circumstances, to set up an explosion by bringing a cloud of coal-dust into contact with an ordinary naked light, yet that such a contingency is so improbable as not to require special notice or precautions.

The cases, however, which demand more serious consideration are those of ignition by the flame of a shot.

J. B. Atkinson, 660, 661.

In regard to this it is maintained that given coal-dust in a finely divided condition, free from impurity, and dry, a shot which gives off flame will, in the first place, raise the dust by concussion, and probably ignite it with explosive effect, in the complete absence of fire-damp.

Lucas, 3192, 3206, 3224. Garforth, 3768. Ashworth, 4622, 4623. Isaac, 4940, 4957, 5021. Hood, 5931–5933. Wilkinson, 5549, 5550.

Many witnesses express the conviction that dust of the kind stated above is a source of constant danger, having regard to the possibility of flame from a blown-out shot; that it may initiate an explosion; and that coal-dust "should be equally "guarded against as fire-damp."

Bell, 1539, 1544, 1606-1608.

Mr. Bell describes an explosion at Brandon caused by an overcharged shot in the main trolley way, in which he states gas could not possibly have been present as the road was in a stone drift, driven perhaps 20 years before. In this accident two men were burned, and there were traces of the explosion for about 50 yards on each side of the shot. The shock was felt for about 1,100 yards in-bye from the point where the shot was fired.

Lucas, 3195–3208, 3271–3275, 3327–3340, 3347–3356, 3377–3383.

Mr. Lucas describes two explosions in narrow headings in the Bullhurst seam, in No. 6 Pit of the Silverdale Works, Staffordshire. They were caused by overcharged shots. In the first case the flame travelled 50 yards, where it burned two men. In the second case flame was seen by witness to fill the adit for 30 or 40 yards; timbers were blown out and rails were torn up for a distance of 400 yards. Mr. Lucas cannot be certain, however, that in these two instances gas was not present in a very small quantity.

He also refers to an explosion caused by a blown-out shot in the Bullhurst seam, in which eight men lost their lives. He maintains that gas could not possibly have been present, because the shot was only two yards from the top of the air course, where it went into the return.

Mr. Austine thinks a shot might initiate an explosion in coal-dust alone. He has, however, never known a blown-out shot to set fire to coal-dust.

Austine, 4312–4316, 4360–4366.

Mr. Forman states that the first effect of a blown-out or overcharged shot is to disturb the dust and ignite it, and that the temperature of the dust rises to such an extent that it explodes.

Forman, 5046–5048. 5121.

Mr. Thomas considers that dust which would not be dangerous with an ordinary naked light might be very dangerous in the presence of a blown-out shot.

Thomas, 6215, 6216, 6273–6276, 6290.

The experiments made in England and on the Continent strongly corroborate these opinions.

In regard to the Prussian experiments, Sir F. Abel says, that they have shown that it is not impossible that coal-dust alone ignited with shot-firing on the scale in which it occurs in actual practice in the mine may, without the presence of fire-damp, bring about a coal-mine explosion.

Abel, 2383–2386, 2396, 2468.

The experiments made by Mr. H. Hall in 1890, 1892, and 1893 on a larger scale, and in the shafts of mines, appear to be conclusive in the same sense, although they show that an explosion is not a certain consequence of every shot that blows out or emits flame, but depends on many circumstances affecting the condition and quantity of the dust, the nature and strength of the explosive, the size of the galleries or shaft, &c.

H. Hall, 220, 295, 318, 319, 332, 358, 359, 372. Appendix I., XVIII., XIX.

The Prussian Commissioners reported that "if absolute immunity from blown-out " shots could be obtained, the dangers which are brought about by coal-dust would be " almost entirely prevented." In their experiments they found that no shot, other than a blown-out shot, caused an explosion of the dust.

Stokes, 3040, 3041.

It is, however, the opinion of several witnesses that the danger is not confined to blown-out shots, but that an overcharged shot which does not blow out, or one which partially does the work for which it was intended, may exhibit flame and therefore ignite the dust. In the opinion of Mr. W. N. Atkinson, the explosions at Seaham in 1871 and 1880, at Elemore, at Usworth, and at Altofts, were caused by shots which did not blow out.

W. N. Atkinson, 2174. Galloway, 1563, 1564. Abel, 1544. Lucas, 3190. Forman, 5040.

The opponents of the coal-dust theory, however, do not regard either the Prussian or the English experiments as conclusive. They assert that neither represent the practical conditions existing in the working of an ordinary mine. Thus they contend that the quantity of dust used is excessive, and that the atmosphere has been so thickly laden with dust that no living being could breathe in it. In the Prussian experiments it is said that "the dust had to be perfectly black so that they could not see through " 2 feet of it before it became inflammable or explosive."

Galloway, 1073. Dickinson, 1276, 1401, 1423. Bell, 1536, 1631. Stokes, 3014, 3021, 3041, 3063, 3064. W. F. Hall, 3590, 3495–3498. Bedlington, 5687. McMurtrie, 6138. Morgans, 1935. Lishman, 2798, 2799, 2865, 2889. Woods, 5188.

It must, however, be borne in mind that the experiments are not intended to represent the normal condition of a pit, but only the state of things which would be the result of the concussion caused by a blown-out or overcharged shot, or by a small explosion of fire-damp. Mr. Burrows says that he has seen the dust as thick in the air underground as Mr. Hall could make it in his experiments.

H. Hall, 340. W. N. Atkinson, 2228. Burrows, 4124. Forman, 5049, 5050.

It is further objected that there is no certainty that fire-damp was not present in the shaft used by Mr. Hall in his earlier experiments, as it might have been given off from the strata and have lodged in the upcast shaft.

Lishman, 2803, 2866.

This objection was not shared by Messrs. Atkinson and Galloway, and it may be pointed out that in the experiments which were conducted in ordinary chambers and galleries there could by no possibility have been any gas present, and yet undoubted explosions were successfully obtained. This point appears to have been now completely set at rest by the last experiments of Mr. Hall. On these occasions the air in the shaft was examined both before and immediately after an experiment, and the analysis showed that there was no trace of carbon monoxide, or marsh gas.

J. B. Atkinson, 941. Galloway, 1208. Appendix XVIII. Appendix XIX.

These very important experiments were conducted by Mr. Hall at the instance of the Commissioners, and under the following circumstances.

Having regard to the authority given to us in Your Majesty's Commission to make further experiments in pursuance of our inquiry, we carefully considered the nature and character of such experiments as might be undertaken, the expense of making the same, and the information to be expected from them.

The witnesses whom we have examined on the subject are almost unanimously of opinion that such experiments, to be convincing to those who are at present sceptical as to the coal-dust theory, must be carried out on a scale and in a manner as nearly as possible resembling the actual conditions existing in a coal mine. These conditions can only be completely fulfilled in the actual workings of a mine, in which case it would be almost impossible to observe the results of explosions, while the circumstances

surrounding each experiment would be open to the same doubt as now surrounds accidental explosions in the ordinary course of working. In fact, the information to be obtained from such an experiment would not differ from that which is already available in connexion with the numerous disastrous explosions which have been investigated in recent years.

The only alternative would be to build a gallery on the surface in imitation as far as possible of the workings of a mine, and in this case, the experiments could no doubt be more securely watched and completely investigated; but witnesses whom we have examined on the subject vary very much in the statement of the conditions which they would deem to be satisfactory. Those who do not accept the coal-dust theory in its completeness, claim that the gallery should be of large dimensions and of great length, in some cases requiring that the size should be equal to that of an ordinary gallery in a mine, and that it should be from 200 to 400 yards, and even half a mile in length. The erection of any gallery on this scale would be extremely costly, and the expense could not be put at less than from five to ten thousand pounds.

It is also claimed that other conditions, such as the quantity of dust used, the nature of the explosive, and its position, should be the same as are usually found in ordinary working.

Even under these circumstances your Commissioners did not feel certain that any definite results would be secured. It is clear that, if the coal-dust theory be correct, the circumstances under which an explosion from this cause takes place must be exceptional, and unless these exceptional conditions should be produced in the course of the experiment no explosion would be obtained. But a negative of this kind would not be conclusive, as it would be impossible to say that there was absolutely no danger because, in a limited number of experiments conducted under conditions which might not be in all respects exactly the same as those which exist in a coal mine, no explosion had been produced.

On the other hand, if the experiments did succeed in producing explosions in a certain proportion of cases, we have heard from the witnesses opposed to the theory that they would not accept this evidence as final, but would be inclined to assume that in some way or another artificial conditions had been created in the gallery which are not likely to arise in actual working.

We are therefore unable to believe that experimental operations of the kind, and upon the scale suggested, would carry greater weight than the partial experiments which have already been carried out, or would be more conclusive than the experience derived from actual facts, and especially from the most recent case of a dust explosion in the Camerton Colliery, where all the conditions required by opponents of the coal-dust theory seem to have been present.

It has, however, appeared to us to be very desirable to ascertain whether the results obtained in past experiments would vary according to the nature of the dusts employed. We therefore addressed a letter to the Secretary of State for the Home Department, suggesting that Mr. Hall should continue the series of experiments which he had made with certain Lancashire dusts in June 1892 and January 1893, so as to include coal-dusts collected from the principal seams in the respective mining districts—each separate dust to be tested as to its inflammability. Fifty-two samples of dust were received by Mr. Hall from 45 different collieries and from 36 different seams, and with the exception of four or five samples all were tested. The districts represented were Northumberland. Durham, Yorkshire, Derbyshire, Nottinghamshire, Staffordshire, South Wales, Monmouthshire, Somersetshire, Forest of Dean, and Scotland. (Appendix XVIII.)

(Appendix XIX.) The experiments, which occupied 12 days, were conducted in the summer of 1893 in a mine shaft at White Moss Colliery, Skelmersdale. The shaft is 50 yards deep and 7 feet in diameter. Struts of timber, 6 feet long and 7 inches broad, were fixed from the top to the bottom of the shaft at intervals of 6 feet, to represent the timbering of an underground roadway. The ventilation of the shaft was secured by means of a small fan at the surface, driven by hand, and forcing about 750 cubic feet of fresh air per minute to the bottom of the shaft, through 10-inch iron tubes, which reached to within 5 feet of the bottom of the shaft. A wrought-iron cannon was used for the gunpowder shot. It measured 2 feet 11 inches in length, with a borehole 2 inches in diameter, and 2 feet deep, and it was charged in most cases with $1\frac{1}{2}$ lbs. of ordinary blasting gunpowder tamped lightly with coal-dust. The tamping occupied a space of about 12 inches. The amount of charge of gunpowder used in the experiments, viz., $1\frac{1}{2}$ lbs., is somewhat heavier than an average mine shot, but it was fixed upon as being likely to develop a similar flame to that produced by the accidental ignition of a small

quantity of fire-damp in a mine. In other cases a high explosive was used, and was fired from an iron tube.

The conditions under which the samples were collected, stored, and tested were kept as nearly as possible the same in every case. Usually the sample was first tested *in suspension*. If the experiment resulted in an explosion the sample was then tested *at rest*, that is, an interval of 15 or 20 minutes after putting the dust down was allowed to elapse before firing the shot.

The tabulated results of these experiments afford the most instructive reading, and we wish to draw especial attention to the fact that it was the dust from those seams which have been most unfortunate in their history that proved to be the most dangerous under Mr. Hall's tests.

In passing, we would like to note that the dust taken from the Brancepeth Colliery, in which three men were killed on the 24th April 1889 by an alleged explosion of coal-dust, produced in the three experiments made with it violent explosions with flame from 30 to 60 feet above the pit mouth.

The dusts from Walker (Northumberland), Seaham and Usworth (Durham), Leycett (Staffordshire), Clay Cross (Derbyshire), Clifton Hall (Lancashire), Morfa (South Wales), Udston and Blantyre (Scotland), all collieries remarkable in the history of mining for terrible disasters, sustained the evil reputation which has long attached to their respective seams, and under these artificial conditions were the agents of violent explosions, attended by the emission of flame from the pit mouth to the height of 30 to 50 feet. To quote Mr. Hall's words, it would appear that the dust from these and other seams "are almost as sensitive to explosion as gunpowder itself."

At the same time, it is necessary to take notice of the fact that the experiments with dust from districts which have been practically free from explosions, such as the Forest of Dean, Somersetshire, South Staffordshire, and collieries working anthracite, produced little more than the charring of the dust and nothing whatever in the nature of an explosion.

Another point deserving the most serious consideration is that, in cases where a high explosive (ammonite or roburite) was fired entirely without result, the introduction of gunpowder was followed by violent explosions.

A tabulated statement of the results of these experiments will be found in the Appendix, and Your Majesty's Commissioners are of opinion that they afford very strong corroboration of the theory that coal-dust alone may initiate a violent explosion if it be raised into the air, and ignited by a blown-out shot.

We have, however, still to consider some general objections to this theory based on the observations and inferences of the witnesses opposed to it.

One of these objections is formulated by the Accidents in Mines Commission, who in their Report say :—

"Mr. Galloway does not appear to have realised the fact that if dust were the "principal agent in coal mine explosions, every blown-out shot occurring in a very "dusty and dry mine should actually be attended by a more or less disastrous explosion "or conflagration; and that, looking therefore to the enormous amount of powder "expended in shot-firing in this and other countries, and to the not inconsiderable "proportion which blown-out shots must constitute in many localities of the total "number of shots fired, disastrous coal mine explosions would be of more than daily "occurrence if his view were correct." (Lushington, 74.)

In the same sense Mr. Stokes says that the total number of shots fired in the United Kingdom is estimated at 20,000,000 per annum, and that a very large proportion of them are fired in dry and dusty mines in which no watering whatever is practised. "If, then, coal-dust is as dangerous as some persons state, the mystery is why have we "not coal-dust explosions almost daily." (Stokes, 3070.)

This objection does not appear to us to be conclusive. It is clear that in order to set up an explosion there must be a combination of circumstances which probably rarely occurs in the practical working of a mine. Thus, the dust must be of sufficient purity, fineness, and dryness to be easily raised, and to possess explosive qualities. It must exist in considerable quantities at the place where, and the time when, a blown-out shot occurs. It is probable that some dusts are much more easily ignited than others. The flame from the shot must be of considerable size and intensity, and must also be propelled into the dust with great force. The position of the shot is also likely to affect the result. (Lushington, 75. H. Hall, 232, 465. J. B. Atkinson, 894. W. N. Atkinson, 2199–2202. Stokes, 3012, 3041.)

It is further urged that shot-firing is generally done at the working faces where the dust is usually fresher and damper, and also coarser and in smaller quantities, than in (W. N. Atkinson, 2297–2300.)

Galloway, 1132, 1133, 1138. Longden, 3432. Lushington, 34, 55, 74, 75, 63*a*.

the main haulage roads. In the long-wall system especially the working faces are said to be comparatively free from dust.

H. Hall, 462, 475, 528, 529. J.B.Atkinson, 589, 621, 654, 858, 955. Bell, 1632, 1633. W. N. Atkinson, 2160. Lishman, 2789, W. F. Hall, 3609. Garforth, 3831. Williamson, 3969. Burrows, 4121. Martin, 5373. Isaac, 4998–5009.

It is agreed generally that the intakes are the dustiest part of a mine, and that they contain the driest, purest, and finest dust; and also that there is much less inflammable dust at the working faces, and that the return air-courses are comparatively free from dust. In the Durham explosions it is especially noted that the faces were not particularly dusty.

Robson, 4565–4568.

Mr. Robson suggests that dust long exposed to the air absorbs oxygen, and that, therefore, the dust lying in the intakes is more dangerous on account of the air passing over it.

Lushington, 70. Lucas, 3344. Dickinson, 1276, 1405, 1406, 1501. Williamson, 4053.

In Staffordshire, and North and East Lancashire, however, the returns are exceptionally dusty, and are said to contain more dust than the intakes. Mr. Dickinson, speaking of the latter district, says that the working faces "are generally pretty free from "coal-dust."

Moore, 2608. Lishman, 2954, 2956. Williamson, 3989. Robson, 4585 4596. Morgan, 4817. Woods, 5194, 5263, 5272.

Other witnesses found their objections on the negative proposition that they have never known an explosion of coal-dust caused by a blown-out shot, and without the presence of gas.

This view is not, however, supported by the general tendency of the evidence, and the fact that in many cases a blown-out shot does not cause an explosion, even in a dusty mine, does not in any way impugn the value of the evidence, which shows that in other cases a dangerous explosion has been initiated by these means.

Lishman, 2718. W. F. Hall, 3533, 3611.

Besides the conditions already indicated as necessary to an explosion, it may be pointed out that unless the concussion from the shot is sufficiently violent to raise a cloud of dust in the atmosphere, no evil consequences are likely to ensue.

Morgans, 1682 Weeks, 3151, 3152. Longden, 3461.

Some witnesses have asserted that even if an explosion could be set up, it would not be a serious one, nor could it be carried far unless assisted by the presence of fire-damp.

Williamson, 4027, 4039. Brain, 5895, 5896. McMurtrie, 6177.

The evidence, however, given with respect to many explosions where coal-dust has played an important part, and the results of Mr. Hall's experiments, agree in showing that the explosion gathers force for a considerable distance, and continues until it comes to a damp place, or one where the supply of pure coal-dust is insufficient.

Morgans, 1683. Longden, 3429, 3434. Williamson, 4003, 4004. Robson, 4491–4496. Brain, 5785, 5902. McMurtrie, 6067. Woods, 5273.

What appears, at first sight, to be a better founded objection is raised by witnesses who represent the non-fiery seams of the Somerset coal field, the Forest of Dean, the West Durham collieries, and some mines in the Midland district.

These collieries are all more or less dusty, and the practical immunity enjoyed by them for many years from explosions has been claimed as a proof that coal-dust *per se* is not capable of being exploded by a blown-out shot.

McMurtrie, 6105–6190.

Mr. Brain and Mr. McMurtrie refer to the circumstances attending a blown-out shot in a working face in the Ludlow Pit at Radstock, on November 24th 1891. The charge was eight ounces of compressed powder, and was unskilfully placed. The place was dry and dusty, and the dust extended along the whole of the face. The air was travelling at the rate of 200 feet per minute. The seam had been worked for six years under all conditions, and not the least trace of fire-damp had been seen. At a distance of 80 feet a man was slightly burnt; at points 112 and 124 feet from the shot there was force sufficient to roll over two men who were higher up the head. The violence that was developed, however, was not great enough to knock out a single prop, and props were only charred at a distance of eight feet from the shot.

Brain, 5772. McMurtrie, 6130–6168.

Both witnesses object to the term "explosion" as applied to the accident, and regard it merely as a prolongation of flame due to the coal-dust, although Mr. McMurtrie states that the dust no doubt contributed to the force of the gunpowder.

Brain, 5774 McMurtrie, 6177.

Mr. Brain says "that it is not possible for the coal-dust to carry on the explosion "to any great length; that it may add additional fuel to the fire given off from "another cause for a few yards, but that it dies out at a short distance comparatively "speaking. For instance, with reference to the Radstock explosion, from the "information given me, this particular place was dry and dusty; the flame from the "blown-out shot appears to have ignited the coal-dust immediately surrounding the "place, and the flame was carried some few yards along the face of the coal, but a "comparatively few yards only, although there was found an abundance of coal-dust "for hundreds of yards further on. If the coal-dust itself had been sufficiently "dangerous to give off an explosion, I am at a loss to know why the flame was not "carried on more than a few yards. Why was it not carried on all along that face of "coal, because there would be ample contribution from coal-dust in that immediate "vicinity to carry it for 100 or 200 yards, as the case may be."

It is pointed out, however, that the course of the inflammation or explosion was not in a roadway, "so that there would not be any great amount of fine-dust ground up "constantly by the passing of the workmen and horses," but was a new coal face being moved forward, and that therefore the coal-dust would be quite fresh and not particularly fine. It need scarcely be remarked that such dust is not of the most dangerous kind. The argument insisted upon by Mr. Brain is that if the dust was sufficiently inflammable to carry on flame in the entire absence of gas for a comparatively short distance, there could be no reason why it should not have prolonged it indefinitely. Brain, 5783, 5784.

Mr. McMurtrie also described the particulars of a blown-out shot in the Middle Pit, No. 5 seam, Radstock Collieries. The charge consisted of 30 ounces of compressed powder, and was therefore an exceptionally heavy one. There was no coal-dust about, the place being rather wet. The effects of the concussion were felt at a point 300 yards away from the shot; lights were extinguished in that part of the pit; doors were opened and the ventilation was reversed for a few minutes. "The effect, however, was "not confined to that particular part of the pit, but took effect at a point 154 fathoms "higher up in the upper group of seams—the Radstock group—where the concussion "was distinctly felt, and even some doors were partially opened." Owing to the absence of fire-damp, and also of coal-dust, Mr. McMurtrie argues that the whole of these effects were produced by the gunpowder charge, and on this account is the less disposed to consider that there was anything remarkable in the extent of the flame and force in the instance of the blown-out shot in the Ludlow Pit, above described. The witness could not give any evidence as to how far the effects of flame were visible because his attention was not called to the occurrence at the time. McMurtrie, 6081–6104.

In this connexion it may here be stated that the length of flame issuing from a blown-out shot of gunpowder has been estimated by various witnesses at from 4 to 15 feet. Mr. H. Hall states that the utmost limit of flame with two pounds of gunpowder would be 4 or 5 yards. H. Hall, 484. Robson, 4595. Brain, 5775, Hood, 6026. McMurtrie, 6103.

Mr. Longden points out that the Chesterfield experiments demonstrated that there was a considerable difference in the inflammability of different kinds of dust. Both he and Mr. Robson think it extremely important to distinguish between them.

Mr. Longden believes that a serious danger exists with certain inflammable dusts produced by a highly bituminous coal. On the other hand, he is convinced that the dust from a non-bituminous coal is entirely harmless. He considers that there is no danger whatever attaching to the dust in the Midland district unless a large percentage of gas were mixed with it. In support of this contention he adduces a case at Manners' Colliery. In this instance there was an explosion of fire-damp, and although there was an abundance of dry and fine dust which became ignited, the inflammation, as shown by the coked dust, only extended for about 20 yards. Longden, 3396, 3412–3415, 3422–3428, 3433, 3434, 3450, 3451, 3472. Robson, 4458.

It is remarked that the Prussian experimenters came to the conclusion that all dusts, except the Pluto dust, were "more or less harmless." Mr. Galloway's opinion is that the Prussian experimenters made a mistake in attempting to set up such distinctions; and states that shortly after their report an explosion killing 200 men occurred at the Camphausen Colliery, which had been regarded as entirely free from fire-damp, and the dust of which they had pronounced to be a "safe dust." "In attempting to say "from experiments on a small scale that one kind of coal-dust is explosive, and "another is not explosive, one attempts to prove too much; for you must take it for "granted that there are conditions in a mine after an explosion has been begun which "will carry on that explosion with dusts, which, in an ordinary experimental "apparatus, would not give any results at all." Stokes, 3041. Galloway, 1032.

Mr. J. B. Atkinson is inclined to believe that there are certain kinds of coal-dust which would not produce an explosion, and thinks it is important to determine this by means of experiments.

This opinion is shared by many other witnesses. J. B. Atkinson 656–659. H. Hall, 266, 267, 317, 333. Lishman, 2703, 2708. W. F. Hall, 3552, Williamson, 3987. Morgan, 4818. H. W. Martin, 5355–5360.

Great light has been thrown upon the controversy, thus raised by the conflicting opinions of many witnesses, by an explosion which occurred subsequently to the taking of this evidence at the New Pit, Camerton Colliery, near Radstock, on November 13th, 1893.

The circumstances of this explosion, occurring as it did in one of the pits which were supposed to enjoy an absolute immunity from such accidents, and in which during an experience of about a century the presence of fire-damp has never been suspected, are so important in their bearing on this inquiry, that we desire to call especial attention to them. Garthwaite, 6320. Garthwaite, 6305–6.

Garthwaite, 6301–6304. The pit is 314 yards deep, and contains five workable seams. In descending order they are: the great vein, the top little vein, the middle vein, the sliving vein, and the under little vein. The explosion took place in the great vein, which has been worked since the opening of the mine.

Garthwaite, 6307–6309, 6349, 6379. Dixon, 6727–6731. Open lights were in use throughout the mine, and no precautions of any kind have ever been taken against gas. Faults sometimes occur in which water, but never gas, is found. No faults, however, had been cut in the neighbourhood of the point of origin of the shot. Tests, made after the explosion by Professor Dixon with Clowes' hydrogen lamp, which detects gas in proportions as small as a quarter per cent., failed to reveal the slightest trace of it, either in the intake, the return, the working faces, or in the cavities caused by the falls of roof.

Garthwaite, 6314. Blasting is carried on to the extent of about 100 shots per week, and entailing a weekly consumption of about 50 pounds of gunpowder.

Garthwaite, 6321, 6324. On the night of the explosion the two deceased—a man and a boy—were sent down with instructions to rip down some of the roof in the incline at a point where an upheaval of the floor caused the coal in the waggons to grind against the top.

Garthwaite, 6323, 6331–6334. These two workpeople—the sole occupants of the district at the time—according to the evidence, fired two shots. The first had evidently done its work, and a quantity of dust raised by carting away the débris, would probably remain in the air till the second shot was fired—an interval probably of about two hours.

Garthwaite, 6391. Brown, 6510, 6538, 6555. The second, and fatal shot, was evidently an unskilful one, and badly placed. According to the evidence of Brown, the fireman, it would appear that seven or eight inches of gunpowder had been inserted when two inches would have sufficed for the work it was possible for it to perform.

J. S. Martin, 6617. Mr. Martin, in his report to the Home Secretary, states:—

"The shot-hole was commenced a foot on one side of the centre of the incline and about seven inches up in the roof, but it rose about four to five inches more in its length of 10 inches, and it was evidently intended to rip down a length beyond the end of the hole, but was cut off from doing so by a joint three inches beyond which Hawkins must have failed to notice. The result of this joint was that the hole, otherwise a very short one, was with half to three quarters of a pound of powder over-charged."

Garthwaite, 6327, 6338, 6339, 6392. Brown, 6515. J. S. Martin, 6596. After the explosion, which is supposed to have been the consequence of this shot, a prop was found immediately in front of the hole which had been bored; the boring tools were discovered in a refuge hole close by; a small amount of débris—about one cwt.—was blown down by the shot; and the candlesticks of the deceased were found in a refuge hole 35 yards from the spot where they had evidently been sitting while the shot went off. The two bodies lay 54 yards from the spot, or about 19 yards from the refuge-hole in which they had been sitting, the presumption being that when the explosion occurred they ran out and left their candlesticks.

Garthwaite, 6340–6342. At a distance of 9 ft. 6 in. coked dust was found in crevices in the rock and on the timber, while there were slight traces of charring on the timbers generally.

Garthwaite, 6345, 6400. J. S. Martin, 6589. The force of the explosion was apparently slight on both sides of the shot for some distance, and appeared to develop as the distance increased. Outwards, 128 yards from the shot, the wheel on the incline had shifted its position; then there was a succession of large falls extending to the bottom of the incline, 311 yards from the shot. The effects of the explosion at a distance of 1,180 yards from the seat of the explosion were more noticeable than anywhere else, and at this point two doors were blown into fragments, and the door-posts and the iron-door framing, $1\frac{3}{4}$ in. by $\frac{1}{2}$ in., were shattered as if a violent explosive had been fired directly into them. The incline was nearly one continuous fall with the exception of a few timbers left standing.

Garthwaite, 6343. Traces of the explosion were found at a distance of 1,261 yards from the shot going outwards, and it was here that the last fall of roof occurred.

Garthwaite, 6346, 6468–6471. J. S. Martin, 6587, 6592. The course of the explosion appears to have been arrested at this point, which was about 700 yards from the shaft, by a wet piece of roadway 53 yards long, near Tom's Road.

Garthwaite, 6402, 6472. The immediate neighbourhood of the shot was particularly dusty, owing to the grinding of the coal in the waggons against the roof, and there was more or less dust in the incline generally. On the little vein, from the bottom of the incline to the bottom of the dipple, there would be less dust, but with that exception the whole of the great vein road and the horse road was dusty.

J. S. Martin, 6687–6696. According to Mr. Martin's evidence, there was a damp space at the bottom of the incline 30 or 40 yards in length, and the explosion passed over it by means of the dust in the trams that were standing there.

Three reasons are given for the occurrence of an explosion of coal-dust in a mine which had been entirely free from explosions both of gas and dust for a period of 100 years. Firstly, it is pointed out that the roadways are now much longer, and that in consequence of the coals travelling a greater distance there is more leakage of dust from the open waggons. Secondly, the ventilation has been greatly increased recently, causing the roads to be drier and dustier. Thirdly, machine drills, boring holes $1\frac{7}{8}$ in. diameter, have during the last five years taken the place of the hand drills, which only bored holes 1 in. in diameter, thus involving heavier charges of gunpowder. Garthwaite, 6315–6317, 6350, 6351, 6442.

In view of this experience, Your Majesty's Commissioners cannot doubt the possibility of an explosion from coal-dust alone, even in mines where no gas has ever been known to exist.

At the same time the rarity of the event shows that the danger in such cases is somewhat remote, and this opinion receives confirmation from the recent experiments by Mr. Hall, who has been unable to obtain any explosions in testing dusts from the following seams:—

Great Row Seam, Great Fenton Colliery, South Staffordshire. Appendix XIX.
Shallow Seam, West Cannock Colliery, South Staffordshire.
Big Mine Seam, Moston Colliery, Lancashire.
Big Vein Seam (anthracite), Gwaun-cae-Gurwen Colliery, Glamorganshire.
No. 6 Seam, Radstock Colliery, Somerset.
Rocky Seam, Forest of Dean Colliery, Gloucestershire.

We think that the comparative immunity enjoyed by the Forest of Dean collieries, and the non-fiery seams of the Somerset coal field, may probably be established with regard to other seams, but both Mr. W. N. Atkinson and Mr. Galloway are of opinion that the finest dust of all kinds of coal is inflammable or explosive with the exception, possibly, according to the latter gentleman, of the driest kinds of anthracite. Galloway, 1032. W. N. Atkinson, 2207–2212.

On a general review of the evidence on this point, we have no hesitation in expressing our opinion that a blown-out shot may, under certain conditions, set up a most dangerous explosion in a mine even where fire-damp is not present at all or only in infinitesimal quantities; and while we are prepared to admit that the danger of a coal-dust explosion varies greatly according to the composition of the dust, we are unable to say that any mine is absolutely safe in this respect, or that its owners can properly be absolved from taking reasonable precautions against a possible explosion from this cause. But, even if we had been able to come to a different conclusion, and to agree with the minority of the witnesses examined who think that coal-dust alone cannot originate an explosion, we should still have to call attention to the serious danger which results from the action of coal-dust in carrying on and extending an explosion which may have originally been set up by the ignition of fire-damp.

III.

An Explosion of Fire-Damp may be intensified and indefinitely carried on by the presence of Coal Dust.

A small explosion of fire-damp may originate a great explosion of coal-dust. The initiatory explosion may raise a cloud of dust, and this cloud may then be ignited and explode, raising thereby another cloud to be exploded in its turn, and so on as long as the supply of coal-dust continues. These successive ignitions and explosions may follow each other so quickly as practically to form one explosion. Abel, 2380, 2397.

Sir Frederick Abel has come to the conclusion that coal-dust undoubtedly has the power of carrying on explosions, and possibly under "extremely favourable conditions" of carrying on explosions almost to an indefinite extent in coal mines; and these favourable conditions are: "as regards the nature of the dust, its physical condition "and its composition, and the quantity of dust existing and suspended in the air at "the time of the explosion." Abel, 2381, 2382.

"Theoretically there is no limit" to which an explosion might be carried on by "coal-dust; but of course it is very difficult to say whether there is practically any "limit, but looking to the great commotion set up by the rush of gas produced as the "explosion originates and as it progresses, the motion of the air is such that particles "of coal-dust must be whirled up into it and must continue to produce a mixture of "sufficient intimacy and sufficiently highly charged with inflammable particles to "develop afresh the conditions which existed originally when the explosion was started, "and, in that way the explosion may be considered to be a continuous one." Abel, 2395.

Lishman, 2750.

Mr. Lishman, who is not an extreme advocate of the coal-dust theory, states: "a "local explosion of a mixture of fire-damp and air, occurring, we will say, at the face "of a working in a particular district, might not reach very far out-bye if it was "only a very small explosion, or at all events it might reach the shafts if it were an "explosion of some magnitude; but the chances are, that it would not go very far "beyond that. But, if dust were present upon the intakes on the opposite side of the "shaft, I think the chances are that it would extend almost to the remotest part of the "pit, if the whole of the intakes were covered with dust."

Lishman, 2759–2767.

He maintains, however, that dust inflames but does not explode, but as the effects after a certain distance are not materially different from those which would be produced by a gas explosion, the distinction is apparently only in terms.

Stokes, 3049.

Mr. Stokes, it will be seen from the following quotation from his summing up, is not disposed to underrate the danger arising from the presence of coal-dust in gassy mines, although he does not appear prepared to go the full length of admitting that coal-dust may prolong an explosion indefinitely. "The initial flame which starts an "explosion in a dry and dusty mine, whether from a blown-out shot or small fire-damp "explosion, may be extended partly by the complete combustion of dust and partly by "the gas distilled from the fine coal-dust due to heat, and if sufficient air be present, "the same is consumed or fired at the first passage of flame, but if not then consumed "an inrush of air may supply the required oxygen and carry the flame back, causing "what is termed a secondary explosion. A small explosion, which might be confined "to one part of a mine, as far as fire-damp was concerned, might become a widely "extended one if the mine was dry and dusty, and if there be sufficient dust lying "about which could be raised by the passage and force of an explosion to carry the "flame to other gas-laden spots. And thus an explosion, which would otherwise be "trifling by comparison, might be extended into one that was serious; but in such "cases the range of dust flame would be limited in proportion to the magnitude of "the first disturbing force, and the quantity of dust in the atmosphere."

Morgans, 1677. Moore, 2579, 2599. Lishman, 2686, 2749. Burrows, 4075. Austine, 4317, 4321. Robson, 4437. Ashworth, 4606. Morgan, 4816–4821. Forman, 5048. H. W. Martin, 5347, 5348. Wilkinson, 5654. Hood, 5934, 5935, 5943, 5944. Thomas, 6199–6202, 6229, 6237, 6238.

The probability of such a carrying forward of the explosion, or inflammation, as some witnesses call it, is accepted by many of those who do not favour the idea that an explosion can be initiated in coal-dust alone, or can be set up by the flame from a blown-out shot. Almost all the witnesses concur in the opinion that coal-dust is capable of aggravating the effects, and of prolonging the flame, of an explosion of fire-damp, and that therefore it is an element of danger in mines giving off fire-damp.

It has been shown that Mr. Hall's first experiments in mine shafts, which were undertaken for the purpose of demonstrating that coal-dust may not only be ignited by the flame from a shot or a small explosion of fire-damp, but that the dust having been fired is capable of developing an explosion which may continue indefinitely so long as an abundant supply of dry, fine, and pure dust exists, did not meet with general acceptance on account of the conditions under which they were made. Messrs. Galloway and W. N. and J. B. Atkinson mainly rely for the establishment of their case upon the phenomena attending the large explosions. Many explosions have been cited as bearing out the coal-dust theory and as presenting the features declared to be common to these gigantic and widespreading disasters. These distinguishing characteristics have already been stated:—The enormous distances traversed which render sudden outbursts of gas an extremely difficult, not to say improbable explanation; the course of the explosion which is found to be along the intakes and not the returns—corresponding in fact with the line of dust and not that of gas; the freedom from damage in roads which were damp, or which contain, as in the case of horse ways, impure dust; the absence of any indications of alarm on the part of those in the mine, which would certainly have been shown had there been an outburst of gas; and the fact that many of these mines had been at the time of the catastrophe worked with open lights. All these particulars have been frequently referred to by witnesses who have given evidence upon special cases. For the purposes of this report it is not necessary to refer to each explosion that has been thus mentioned in support of the coal-dust theory, but it will be quite sufficient to speak briefly of those explosions which are said to be good examples of the power of dust to propagate an explosion, and upon which, moreover, rebutting evidence has been given.

Morgans, 1686, 1688, 1713. Stokes, 3070, 3075. Robson, 4431.

It is objected generally that all the explosions which are claimed as coal-dust explosions have occurred in fiery mines, and that there is no instance in which the total absence of fire-damp can be demonstrated, and Mr. Morgans states that "fire-damp "has been the backbone of the explosion" in every instance. This evidence, however, was given before the recent explosion in the Camerton Colliery,

That such explosions have generally taken place in mines where there has been fire-damp is acknowledged; at the same time it is asserted that none of the monster explosions have occurred in mines that were not dry and dusty. Mr. W. N. Atkinson says:— (J. B. Atkinson, 828. W. N. Atkinson, 2113, 2114.)

"I do not think I have known many gaseous mines which were not dusty, or a dusty "mine which was not gaseous, to a certain extent. The question of dust and gas is "so intimately mixed up together, that it is very difficult to draw a line in that "direction."

We now proceed to give a brief account of some of the principal examples brought to our knowledge in the course of this inquiry.

Seaham, 8th September 1880.

The explosion originated at a point about 100 or 150 yards from the shaft in the main intake, and at a very dusty place. (Bell, 1507, 1508, 1551. Forman, 5059.)

It was an ordinary shot, not a blown-out shot, in the stone. (Bell, 1569. Forman, 5057, 5058.)

There were no cavities in the roof of the intake, and it is impossible that gas could have been given off from the strata. (Bell, 1627. Burrows, 4146–4148. Forman, 5154.)

The quantity of air passing was about 60,000 feet per minute, and it is almost impossible that gas could have been present. Naked lights were in use at the point of origin. (J. B. Atkinson, 958. Bell, 1550, 1570. Burrows, 4067. Forman, 5060. Forman, 5063.)

There was little disturbance at the point of origin. The drilling gear was undisturbed. (Bell, 1601.)

The explosion was confined to the main haulage roads, and did not reach any parts of the mine where there was gas. (Bell, 1510.)

In order to account for the explosion by gas alone, it would be necessary to assume the sudden appearance of gas on different points along the line of the explosion, which was 7,500 yards in all, because there are three distinct currents of air which separate close to the downcast shaft and the explosion extended along each of these long lines of roads, and in one of them crossed the downcast shaft. (W. N. Atkinson, 2122, 2125.)

The difficulty just mentioned remains even if the contention of the other side be true, that the explosion originated in another part of the mine, and was caused by the ignition of gas coming from a fall in the South Way. (Bell, 1598–1600. Stokes, 3044.)

Mr. W. F. Hall, who gave evidence at the inquest, is of the opinion that the explosion was caused by gas and intensified by dust, but "if the dust had not been there, the "explosion might probably have been of the same extent that it actually was." (W. F. Hall, 3596. W. F. Hall, 3519, 3529.)

"There might have been a large quantity of gas, and the first explosion coming in "contact with other reservoirs of gas, might have caused, and would have caused, "the explosion to have extended quite as far and further than it did." (W. F. Hall, 3531.)

"Did you find any evidence of such accumulations of gas in the course of the explosion?—No, we did not."

Risca, 15th January 1882.

This explosion, causing the death of 4 men and 60 horses, occurred under exceptional circumstances, when all the workmen, with the exception of the four human victims, had been removed from the mine. (Wilkinson, 5537–5548, 5571–5582, 5595–5601.)

The explosion is said to have originated in a main intake swept by an air current of about 60,000 cubic feet per minute, and at a spot from 200 to 300 yards from the bottom of the down-cast shaft.

Although the mine is admitted to be a very fiery one, it is contended that no gas could have been present in this intake, not only because of the perfect ventilation, but because the intake was practically in a stone drift, and, moreover, because there were no old workings near the spot from which gas might have been drawn out to contribute to the explosion.

It appears that four shots were fired, and it is suggested that the dust raised by the concussion of the third and fourth shots was ignited by the second shot, which had hung fire.

Like other large explosions, this one proceeded along the main intake to the foot of the shaft and thence went to bank, blowing off the top of the fan.

It appears that up to the time of the explosion, it had been the practice to damp the roads by means of watering cans, but dust was adhering to the sides and roof to the extent of about a quarter of an inch thick; and it was observed that there were no traces of the explosion in thoroughly wet places.

Morgans, 1771, 1778.

On the other hand, Mr. Morgans points out that this particular seam of coal is about 9 feet thick, and he suggests that the removal of the coal caused dislocations and cavities in the roof capable of containing large accumulations of gas.

Altofts, 2nd October 1886.

Garforth, 3689, 3732.

This is said by Mr. Galloway to be the best example of a coal-dust explosion without the presence of fire-damp that he has ever known, and it is claimed that fire-damp played no part whatever in the explosion.

Garforth, 3698, 3707, 3721, 3755, 3756.
Galloway, 1083. Garforth, 3729. J. B. Atkinson, 834.

Three shots were fired in a main haulage road, known as the "West Chain Road." It was a very dusty road, and this was the first time a shot had been fired on a main haulage road in the history of the colliery—a period at the time of the disaster of 23 years. It is supposed that the first two shots raised the dust, and the third shot—which has been variously described, but which was probably an overcharged shot—fired it. The shot was not in coal but in stone.

Galloway, 1214. Garforth, 3703. 3705.

It is argued that if gas had been present in the roof and above the airway the concussion from shots 1 and 2 would have dislodged it, and that it would either have been carried away by the ventilation or fired by the naked lights which were near.

Garforth, 3744–4746.

Altofts had been an open light colliery for 20 years, but safety lamps had been introduced at the coal face a short time before the explosion.

Garforth, 3709, 3710, 3809, 3868.

The refuse made in working practically fills up the goaves quite solid, and it is impossible that they could have given off any gas.

Garforth, 3737, 3862.

That no gas issued from the lower seam was ascertained by a pit sunk for that purpose after the disaster.

Garforth, 3692, 3810–3813.

The roof was said to be very bad after leaving the shaft pillar, or the fringe of the shaft pillar, and a great portion of it was resting on timbers, but where the explosion was originated it was a natural solid roof only 7 or 8 feet above the road level.

Garforth, 3693, 3694.

The volume of air passing this spot was about 40,000 to 50,000 cubic feet per minute, which, it is said, would be sufficient to sweep out the gas if any were lodged in the roof.

Galloway, 1214. Garforth, 3713, 3854.

Even the main returns were free from gas, or at any rate contained less than one quarter per cent.

J. B. Atkinson, 839, 840. Galloway, 1218, 1219.

It is just possible that in the intake there was a very small quantity of gas which had escaped from the gas-fittings at the bottom of the downcast shaft, "but the "probability is that the trace of gas in the air was so small that it had no effect on "the result." "In none of these explosions," says Mr. J. B. Atkinson, "would I "assert that the air current was free from fire-damp, or from coal-gas, as in this case; "in no case can you assert that in a mine."

Garforth, 3822, 3823.

The immense force developed was demonstrated by the mutilated state of the bodies of the deceased.

Garforth, 3716.

Those roads containing coal-dust were affected, while those roads containing dirt-dust, or only a slight sprinkling of coal-dust, were not affected.

Garforth, 3726–8.

In every case no damage was done in the returns, and no damage was noticed on wet roads.

Williamson, 4044. H. W. Martin 5534,

On the other hand it is argued that Altofts is really a fiery mine, as shown by the fires that broke out in the pit after the explosion, and that gas must have been present.

Morgans, 1957–1973.

Mr. Morgans suggests that gas was in the roof strata, and was ignited at some portion of the West Chain Road. He says:—

"Given the ignition of a small quantity of gas in the roof at one point of that chain "road, then I think it is possible that the ignition of that gas would carry on an "explosion through passages in the roof strata a considerable distance beyond, where "it may come to another lodgment of gas over the timbers of the way in a cavity. "You will find it burst down into the road at that point. Then here is where the "importance of coal-dust comes in. If you had no coal-dust there, perhaps there "would be an end to the explosion, but by the bursting down of that flame into the "road the coal-dust assisted by the fire-damp is capable of carrying on the explosion."

It will be observed that, even on the theory of this witness, the dust played an important part in maintaining and extending the explosion.

Elemore, 2nd December 1886.

Mr. W. N. Atkinson reports as follows:—

Lishman, 2768, 2827.

"A dust explosion originated by the firing of a shot on a main intake. One special "feature of this explosion was that it affected four different levels, passing from the

"level in which it originated down the down-cast shaft, and extending into three "levels below, and ascending also to the surface by the down-cast shaft."

It originated in a seam which was not fiery. J. B. Atkinson 976.

Elemore is naturally a dry pit but not very dusty. The point of initiation also was dry, but not very dusty. Gas had never been found at this particular spot. Bell, 1516. W. N. Atkinson, 2316, 2317, 2325.

It was very unlikely that gas would be given off in the main haulage roads because they were old roads. Bell, 1530.

The blasting tools were not disturbed. Bell, 1603.

On the other hand, Mr. Lishman, the manager of the mine at the time, maintains that it was not a dust explosion, and that it was never proved that a shot was fired. Lishman, 2769, 2824, 2855.

He points out that it is not a dusty seam, and that there was not sufficient dust to cause an inflammation. Lishman, 2773, 2824.

He states that the floor was damp, and that the mine was not a dry one; but admits that where the explosion is said to have commenced was dry, although not particularly dusty. Lishman, 2776–2779.

At this point he had never seen gas, nor has anyone else. Lishman, 2771, 2824.

He differs from Mr. W. N. Atkinson, who says that the shaft was "exceptionally "dry." "Pumping operations were going on in the shaft every week, and it was "partially a wet shaft." Lishman, 2773, 2774, 2967.

Mr. Lishman accepts neither the gas theory nor the coal-dust theory, but believes it possible that an explanation may be found in the electrical state of the atmosphere. He says:—

"I have perhaps leaned to an idea of this sort, although I do not put it forth as an "explanation of the explosion at all. I believe there was a tremendous lot of electricity "in the air that night, a tremendous lot of lightning, and lightning has been known "to go down shafts. I suppose, when lightning exists, it changes the conditions of "the atmosphere to some extent, and that a certain amount of ozone is formed, which "is oxygen so many times intensified, and assuming that the shot had been fired, and "assuming that a cloud of this atmosphere had passed the point at the time, then "I think that might have caused an explosion. Of course it is simply theory." Lishman, 2783.

Mr. Robson shares this opinion. Robson, 4484.

Udston, 28th May 1887.

This disaster in the Scottish coal-field involved the loss of 73 human lives, and occurred in the same seam—the splint coal—as a previous explosion at Blantyre, a neighbouring colliery. Moore, 2531.

It is not suggested that in this case the coal-dust alone initiated the explosion, but it is claimed to be an example of the capability of dust to transform a small explosion of fire-damp, caused by the flame from a blown-out shot, into a wide-spreading disaster, limited only by the extent of the dusty roads. Moore, 2567–2569, 2607.

The mine is described as being a dusty one, although there is said to have been some dampness on part of the engine road, and it appears that the explosion followed the line of dust. Moore, 2592–2595. Moore, 2586.

It was a well-ventilated mine, and no gas had been reported previous to the explosion. After the explosion, and before the restoration of the ventilation, gas was found in small quantities. It is admitted by Mr. Moore, who was the Mines Inspector at the time, that the goaves, which were not extensive, would contain a little gas which, however, would escape to the main coal sixty or a hundred feet above. In any case it is urged that gas did not exist in sufficient quantities anywhere in the mine to account for the explosion. Moore, 2553–2555. Moore, 2558–2564, 2601, 2641.

Scotch safety lamps were in use. Moore, 2565, 2636.

Blasting was not employed except in two or three places where the coal was hard. Moore, 2566.

The killed were within 10 feet of the shaft. Moore, 2652–2655.

Stoppings were blown out, but little damage was done in the shape of falls. Moore, 2551.

Hyde, 18th January 1889.

In this explosion 23 lives were sacrificed. There is no difference of opinion as to its origin. Previous to the explosion the mine had not been considered fiery, and had been worked with open lights, but gas is supposed to have been liberated by a fall of roof and ignited at a workman's light. "The issue of gas from the goaf was incontro- "vertible," says Mr. W. N. Atkinson, "it existed after the explosion; the naked light "was found where the gas fired." As to which was the chief agent of the extension Dickinson, 1305–1321, 1446–1455, 1465–1469. W. N. Atkinson, 2249–2260.

Woods, 5260–5262.

and propagation of the destructive force—gas or coal-dust—is a matter of dispute. While Messrs. Dickinson and Woods both argue that gas continued to feed the explosion—although the former admits that some reinforcement might be due to dust—Mr. W. N. Atkinson contends that coal-dust was the chief factor so far as the loss of life was concerned.

The mine, it appears, was not a dusty one, but it is asserted by Mr. W. N. Atkinson that the parts traversed by the explosion, namely the jig-brow and the levels of the jig-brow, were really the only dusty places in the mine. He further points out that the only damp-road affected was the return airway, where the gas was the destructive agent.

Dickinson, 1493–1498.

In endeavouring to account for these and similar explosions otherwise than by the dust theory, Mr. Dickinson has put forward two theories :—

(*a.*) That fire-damp may be exploded by compression, and by the heat arising from that compression, due to an explosion occurring in another part of the mine, and that there are thus spaces free from flame, through which the air wave travels, and lights the gas beyond them.

Dickinson, 1353.

(*b.*) That when an explosion occurs a vacuum is produced, which sucks out gas from the solid coal, and that thus the explosion becomes self-feeding.

In confirmation of his views, Mr. Dickinson refers specially to the explosion at the Udston Colliery, previously described, and offers it as an example of an explosion propagated by gas evolved and ignited in accordance with the above theory. He says that the explosion radiated from three or four different points of the mine, and, taking the shaft as the centre, that the blasts came from the circumference and united at the shaft.

Dickinson, 1243–1287.

Moore, 2580, 2500, 2607.

On the other hand, Mr. Moore, Her Majesty's Inspector of the district at the time, maintains that although gas doubtless initiated the explosion, there was not enough gas to account for the effects produced either in the goaves, in any cavities in the roof—if such existed, or anywhere in the mine.

Moore, 2585–2591.

He does not think that the explosion had several points of origin and radiated from various places to a common centre, and believes that the apparent movement in opposite directions was really due to the meeting of different currents of the explosion following the dust in every case.

W. N. Atkinson, 2287–2290.

Mr. W. N. Atkinson states that he has never seen indications which had led him to suppose that fire-damp had been ignited by the compression caused by an explosion at a distance.* He can believe that such a wave of compression might cause the flame to pass through the gauze of a safety lamp, but cannot imagine that it could heat the mixture at a distance.

H. Hall, 324, 329.

With regard to what has been termed the vacuum theory, Mr. H. Hall is inclined to think that this might take place to a small extent, and from his own experiments knows that gas may even be drawn out of the coal in old roads.

W. N. Atkinson, 2191, 2192. Abel, 2498, 2500.

It is inconceivable, however, that fire-damp so drawn out could carry on the explosion which had dragged it out, and become at once the cause and the effect.

Morgans, 1680. 1822, 1827, 1828.

Mr. Morgans is prepared to admit that in experimental cases coal-dust may propagate an explosion to an unlimited extent. In a mine, however, this is only possible over a very short distance, and the effects will rapidly die out without a further feeding of fire-damp.

Morgans, 1766.

He accounts for the great extent of some of the explosions that have taken place, by assuming that above the roadways of a mine there is a system of hollows in a gas-impregnated and broken roof which has in many cases transmitted an explosion from point to point without going along the road at all.

Morgans, 1714.

"By removal of a large thickness of a seam of coal, the roof strata are undermined "and consequently are very much disturbed and fractured, and as a result you get "formed in the roof strata, extending sometimes many feet above the seam of coal, "hollows and cavities into which fire-damp naturally rises and lodges. You are bound "to have those hollows and cavities for a very long time after the coal is removed. "After the lapse of a very considerable period the bulk of them are likely to close, but "so long as they remain open they form receptacles for the lodgment of gas."

* Professor Dixon has shown by experiments on a small scale that the violent *detonation* of oxygen and hydrogen will not propagate a compression-wave through a short column of air of sufficient intensity to ignite a mixture of oxygen and hydrogen beyond. Since the explosion-wave of oxygen and hydrogen is far more intense than that produced in fire-damp and air, and since, moreover, the ignition temperature of fire-damp is higher than that of hydrogen, it follows that the compression-wave produced in a column of air by the explosion of fire-damp cannot ignite a mixture of fire-damp and air in another part of a mine.—Memoirs Manchester Lit. & Phil. Soc. (IV.), vol. 4, 1892.

Mr. Morgans states that the main explosion may be in the roof, and that at intervals the flame would rush down into the working road and be carried on to further supplies of gas by means of the coal-dust. Morgans, 1947, 1948.

He points out that the presence of such supplies of gas is unsuspected, and that no indication would be given of its existence by the state of the returns, which might be comparatively free from gas. Morgans, 1899.

He further asserts that monster explosions have generally happened in collieries working thick seams, and that it is in thick seams that such dislocations above the roof are likely to be caused. Morgans, 1767–1776.

In reply to Mr. Morgans' theory, it is argued by Mr. W. N. Atkinson that there was not the remotest possibility of crevices or cavities over the intakes—which were the roads mainly affected—in the large explosions investigated by him. W. N. Atkinson, 2136–2141.

"In Seaham it was a perfectly solid roof, just as it was left by the workmen ?—It "was in rock, and some of it in shale; and also at Tudhoe and West Stanley, and "Usworth and Elemore. Such an idea might be applied to mines worked on the "long-wall system, where the roads are all through the gob, but in mines working on "the pillar and stall system, where the sides of the road are formed by the seam of "coal, I do not think it is possible for such cavities to exist above that road without "either fracturing the roof or crushing considerably the sides of the road." W. N. Atkinson, 2152.

Mr. Moore also points out that such a state of things might occur in a long-wall working, but certainly not in the pillar and stall system. Moore, 2597.

Even if there were such cavities there is no reason why they should not exist also over the returns, which, however, were generally untouched by the explosions; and it is pointed out that in Lancashire there have been extensive explosions in very thin seams. Mr. W. N. Atkinson has never known a case in which an explosion, after traversing a mine for a distance, has then appeared to leap a distance, and to be taken up again at a further point without any trace in the road of the continuance of the explosion. W. N. Atkinson, 2136. 2141–2142.

Sir F. Abel does not think that Mr. Morgans' theory "is sufficient to account for gigantic explosions assuming the complete absence of coal-dust." Abel, 2453.

In view of the overwhelming preponderance of the evidence in favour of the main contention of the advocates of the coal-dust theory, Your Majesty's Commissioners have unanimously arrived at the opinion that coal-dust may greatly extend the area and intensity of an explosion initiated by the ignition of fire-damp and air.

IV.

Fire-damp, in proportions so small as to be non-explosive, becomes inflammable when mixed with coal-dust.

This contention was practically demonstrated by some experiments which were made by Mr. Galloway in 1875. He says:— Galloway, 1001.

"A mixture of air and fire-damp, which was not inflammable at ordinary pressure "and temperature, would become so if coal-dust was added to it, and that given some "inciting cause in the workings of a mine, such as a blown-out shot, or a slight "explosion of fire-damp, which would have the effect of creating a disturbance in the "passages and raising the coal-dust, under the general conditions prevailing in dry "and dusty mines, the result would be that the flame of the original explosion would "be transmitted throughout the workings."

In his report upon the Seaham and other dusts in 1881, Sir Frederick Abel said that coal-dust "will operate even as an exploding agent through the medium of a proportion "of fire-damp in the air of the mine, the existence of which, in the absence of the dust, "would not be attended by any danger." Bell, 1605.

And further that:—

"The proportion of fire-damp required to bring dust in a mine into operation as a "rapidly burning or an exploding agent, even upon a small scale, and with the "application of a small source of heat or flame, is below the smallest amount which "can be detected in the air of a mine, even by the most experienced observer, with "the means at present in use, as has been already demonstrated by the experiments of "Mr. Galloway. Indeed with dusts of highly sensitive or dangerous character, under "those conditions, and very possibly with dusts of not more so than the least sensitive "of the Seaham samples, in the presence of a source of considerable heat and flame, "such as a blown-out shot or an overcharged hole would constitute, a small proportion

" of fire-damp, the possible existence of which in the mine might not be in the " least suspected, may serve as the inciting cause to the development of an explosion " of coal-dust."

Abel, 2387–2390, 2399. J. B. Atkinson, 642.

In his evidence before this Commission, Sir Frederick Abel confirms the above, and states that he regards them as facts "absolutely established." He adds that the least proportion of fire-damp found to be explosive when mixed with coal-dust is about 2 per cent. The least proportion required with common air without coal-dust is about 6 per cent. It has been objected by MM. Mallard and Le Chatelier that the addition of the dust altered the proportion of air and fire-damp in Sir Frederick Abel's experiment. In Sir F. Abel's opinion there was no practical alteration. (Abel, 2495.)

Stokes, 3038, 3039.

The conclusions of Sir F. Abel and Mr. Galloway are confirmed by the Prussian experiments.

Lushington, 40. H. Hall, 219. J. B. Atkinson, 697. Dickinson, 1235. W. N. Atkinson, 2229. Stokes, 3049. Lucas, 3223. Garforth, 3786. Burrows, 4076. Robson, 4560. H. W. Martin, 5319. Forman, 5137. Thomas, 6225.

With the exception of Mr. Longden, all the witnesses who have referred to this branch of the subject have agreed with Sir F. Abel and Mr. Galloway in regarding it as beyond dispute, that dust becomes excessively dangerous upon the admixture of a quantity of fire-damp so small as to be imperceptible upon a safety-lamp and undistinguishable under the ordinary conditions of mining, and that therefore dust becomes a greater danger in any mine where there is the smallest quantity of gas.

As there is always some fire-damp present in the great majority of coal mines in the United Kingdom, the particular danger indicated by the evidence given above is a matter of serious consideration. It is evident that any precautions taken with regard to shot-firing would leave this source of mischief untouched, and it can only be obviated by provisions calculated to prevent the dust from rising or to render it innocuous.

Summary of Conclusions.

Your Majesty's Commissioners proceed to summarise the conclusions at which they have arrived in the course of their inquiry.

1. The danger of explosion in a mine in which gas exists, even in very small quantities, is greatly increased by the presence of coal-dust.

2. A gas explosion in a fiery mine may be intensified, and carried on indefinitely, by coal-dust raised by the explosion itself.

3. Coal-dust alone, without the presence of any gas at all, may cause a dangerous explosion if ignited by a blown-out shot or other violent inflammation. To produce such a result, however, the conditions must be exceptional, and are only likely to be produced on rare occasions.

4. Different dusts are inflammable, and consequently dangerous, in varying degrees; but it cannot be said with absolute certainty that any dust is entirely free from risk.

5. There appears to be no probability that a dangerous explosion of coal-dust alone could ever be produced in a mine by a naked light or ordinary flame.

Precautions.

We have now to consider the precautions which have been suggested to us in order to reduce to the utmost the danger indicated in the above conclusions.

Woods, 5203, 5205, 5221–5223.

Blasting.—Mr. Woods stands alone in his desire to prohibit *all* shot-firing—whether by gunpowder or by any of the high or so-called flameless explosives—in mines which give off any gas; and no mine, he considers, is safe from an irruption of fire-damp, "except under very exceptional circumstances." In place of explosives he would substitute the wedge.

Woods, 5216–5219, 5309.

He admits that the wedge could not be used in the rock, and in that case allows that some of the patent explosives, if under proper supervision and only fired when the men were out of the pit, might be resorted to with perfect safety.

H. Hall, 474. Morgans, 1917. Lishman, 2914. Forman, 5102. H. W. Martin, 5445. Wilkinson, 5623, 5624.

It is generally agreed that to abolish shot-firing would, in many instances, be the means of closing a large number of collieries, especially those working thin seams where there is much hard roof to take down and bottom to cut. The extra cost of production would exclude such collieries from the market, and would throw many thousands of men out of employment. In South Wales, it is pointed out, the increased cost of working would be 1*s*. per ton or even more, and it would be quite impossible to carry them on at a profit except by the aid of explosives.

W. N. Atkinson, 2269–2271.

"If you prohibit explosives altogether you would stop the mine?—Some mines " would probably have to be stopped.

"Would you yourself be prepared to go as far as that?—No, I do not think it is necessary,

"You think it would be sufficient to require in all cases of dusty mines that what "are called flameless explosives should be used?—Yes."

"While it is possible to carry on a colliery with such a roof as at Celynen without "the use of explosives, do you think it is practicable to carry on collieries where you "have thin seams to work and you are driven to take down the roof or to cut into "the bottom, where you have, say, pennant-rock roof, without the use of explosives? "—Not if they have to compete in the market with collieries of the thick-seam "character, worked as they now are. I do not think such collieries as you have "described could very well exist without the use of explosives."

Morgans, 1877.

Some witnesses urge the re-enactment of the provision of the former Act, which required that shot-firing should be carried on between the shifts. They maintain that this should be the practice, even where the high explosives are used, until it is conclusively shown that they are safe in gas as well as in dust.

H. Hall, 376. Moore, 2621. Stokes, 3065, 3094 Morgans, 1721, 1889. J. S. Martin, 6607–6611, 6662–6667.

This precaution is adopted by the Cannock and Rugeley Colliery Company, and is found to have the further advantage of lessening the amount of shot-firing required by the men.

Williamson, 4015.

The Shelton Iron, Steel, and Coal Company, although using a gelatinous cartridge which they consider perfectly flameless, in dangerous places only fire when the workers are out of the pit.

Lucas, 3341.

Gunpowder.—Although there is a strong feeling that to prohibit shot-firing generally is unnecessary even in dry and dusty and in fiery mines, it appears to be a common practice in such cases to substitute some of the higher explosives for gunpowder, and it is submitted by many witnesses that in dry and dusty mines gunpowder may be discarded with a prospect of much greater safety.

H. Hall, 291, 376. W. N. Atkinson, 2267. Moore, 2617. Lishman, 2792. Lucas, 3237, 3238, 3243. Burrows, 4078, 4084, 4100–4105. Forman, 5086. Wilkinson, 5563. Thomas, 6239.

Mr. Stokes says, "In dry and dusty mines all explosives which, although tamped with "noncarbonaceous matter, give off flame on blowing, must be discarded altogether."

Stokes, 3066.

Mr. David Morgan, the agent for the Aberdare and Merthyr Miners' Association, however, alleges that to prohibit gunpowder would stop work at about one-fourth of the collieries in South Wales, even though the prohibition only extended to the use of powder in the coal and not in the rock. He would not object to the substitution of an effective flameless explosive. In any case, however, he would prohibit the blasting with gunpowder in "hot" places where there is dust and a possibility of gas.

Morgan, 4833, 4853–4858, 4866.

Other witnesses have declared that it is quite unnecessary to prohibit the use of gunpowder in collieries like those of the Forest of Dean, which are quite free from gas, and the Radstock non-fiery seams.

Brain, 5815. Morgans 1918.

Since this evidence was taken the explosion in the New Pit, Camerton Colliery, near Radstock, has brought conviction to the minds of former sceptics. Mr. Garthwaite, the manager of the mine, for instance, who says, "I would have allowed anyone to try "any experiment in our pit, I was so confident that the dust would not explode," now advocates the use of a high explosive for blasting in the main roads in the place of gunpowder; while Mr. J. S. Martin, Her Majesty's Inspector for the district, would prohibit the use of gunpowder altogether.

Garthwaite, 6354, 6371. J. S. Martin, 6601–6604.

The experiments made by Mr. Hall, as well as the general experience of all engaged in coal mining, show that a violent inflammation is necessary to initiate a coal-dust explosion, and, that this may be set up by a blown-out shot or other failure of an ordinary gunpowder blasting cartridge. Mr. Hall, however, has not succeeded in obtaining any explosion when what are called flameless explosives have been used by him in his experiments.

The experiments at Ostrau are stated by the Austrian Commissioners to have shown that black powder and its congeners are highly dangerous for fiery mines in which there is coal-dust, and that even in water cartridges these explosives do not give sufficient safety.

Appendix XIII.

Flameless Explosives.—Many different patent explosives have been brought to the notice of the Commission. The so-called "flameless explosives" are largely in use in all parts of the country, and as the result of practical experience are generally pronounced to be effective substitutes for gunpowder, and certainly very much safer. Each of these compositions has its advocates, and each is said to be flameless or practically so. As far as dust is concerned the current opinion appears to be that they are perfectly safe, but there is considerable doubt as to how far the small flash or scintillation which many witnesses say they display, renders them dangerous in the presence of gas.

H. Hall, 295, 473, 562–566. J.B.Atkinson, 962. Galloway, 1026. Dickinson, 1412. Morgans, 1888. Lishman, 2793, 2858–2861, 2916. Lucas, 3234, 3285, 3325. Burrows, 4088. Isaac, 4993. Forman, 5086–5093. Woods, 5218, 5219, 5323, H. W. Martin, 5443–5447. Wilkinson, 5559, 5564. Bedlington, 5677. Hood, 5993. Thomas, 6230. J. S. Martin, 6651.

Mr. Stokes says that he has known one of these flameless explosives to cause an explosion.

Stokes, 3067, 3099.

Ashworth, 4650.

Mr. Ashworth thinks that, in the present state of knowledge, these explosives should be protected in some way.

Garforth, 3749.

"We think they are safe," says Mr. Garforth, for, say, ninety-nine times, but there "may be a mishap at the hundredth."

H. Hall, 568–571.

Mr. H. Hall says :—

"If you fire a blown-out shot by any of these explosives and put a gas-pipe near "the cannon it generally lights it.

"How near ?—Just let the gas play over the mouth of the cannon. But roburite "when it has tamping on, and one or two other explosives, do not seem to light. "Gunpowder lights every time.

"Is it coal-gas you are speaking of ?—Yes.

"That gas ignites more easily as you know ?—Yes, it ignites more readily."

W. N. Atkinson, 2268.

Mr. W. N. Atkinson pronounces :—

"None perfectly safe, but many very much safer than gunpowder."

On the other hand, Sir Frederick Abel states that several have been found which may be safely used even where fire-damp is present :—

Abel, 2420–2422.

"Do I understand you that up to the present time there have, or have not, been "found any explosives which are innocuous in fire-damp ?—Yes, there have been ; "several have been found.

"Do you know whether there is any objection to the use of those explosives ?— "That I cannot say. I do not know to what extent they have been tried in mines "proper, and therefore I am unable to give an opinion as to that or to give any "information as to that.

"But you think that further experiments might produce others which would also be "innocuous ?—Quite so. All those were simple modifications of the original funda- "mental dynamite, the nitro-glycerine preparation ; the basis on which they are "founded is the development, and of a large amount, of non-combustible vapour at "the moment of the explosion, or non-combustible gas at the moment of the "explosion."

Wilkinson, 5612–5622. Burrows, 4107.

As regards the expense, one of the patent explosives is said to cost about the same as gunpowder, taking into consideration the quantity used. Two others are said to entail the same expenditure as gunpowder, but the electric-firing apparatus makes the expense rather greater.

Garthwaite, 6359–6367. J. S. Martin, 6604.

Mr. Garthwaite estimates that the substitution of one of these explosives for gunpowder would increase the expense of blasting by about one-third, and Mr. Joseph Martin thinks the extra expense would be but trifling.

W. F. Hall, 3571, 3572, 3576, 3577. Robson, 4584.

There is a feeling on the part of some managers that gunpowder is in practice safer than any of the high or flameless explosives. Understanding that the latter are perfectly safe, the workmen do not take a proper amount of care. Gunpowder, moreover, they are more familiar with.

Austine, 4402. Robson, 4584. Morgan, 4831, 4834, 4918, 4919. Woods, 5325. Brain, 5818.

It is further objected by some witnesses that the flameless explosives are not so effective as gunpowder, especially in rock.

Morgan, 4847. Isaac, 4996. Woods, 5323.

Exception is also taken to the fumes which, it is said, are given off by roburite in particular. A Lancashire workman was reported to have been poisoned by the gases from it, and we are told by Mr. Woods that the experts at the inquiry came to the conclusion that the fumes were "most deadly."

This, however, appears to be a misapprehension, as we are informed by Professor Dixon, who took part in the Committee of Inquiry (which consisted, besides himself, of two medical men appointed by the proprietors of the colliery and by the Miners' Federation respectively) that the conclusion arrived at was that, although roburite itself was a strong poison, the products produced on its explosion, when strict care was exercised, were not more deleterious than those of other explosives used in mines.

Forman, 5094.

A committee in Durham, appointed to inquire into the matter, decided that although the fumes from roburite were unpleasant, they were not injurious.

Burrows, 4117, 4118.

Mr. Burrows has only known one instance in which the gases from roburite are said to have had any ill-effect.

H. W. Martin, 5497–5499. Wilkinson, 5562.

Mr. Martin and Mr. Wilkinson have had no complaints against the flameless explosives which they have been using.

It is obvious that both the safety of the so-called flameless explosives, and the innocuousness of the fumes resulting from their explosion, must greatly depend upon the proper and regular composition of the explosives themselves.

Lucas, 3234, 3285, 3325.

Mr. Lucas speaks highly of a gelatinous cartridge which he uses in conjunction with the higher explosives, and considers it unnecessary to damp when this cartridge is used. Its use puts on about $1\frac{3}{4}d.$ per ton over the cost of working with gunpowder.

The Austrian Commissioners report highly of an explosive called Wetterdynamite, and their experiments show that loose charges of this substance failed to ignite the most dangerous coal-dust in the absence of fire-damp. The Commissioners accordingly report that the safety obtained with soda-wetterdynamite is very great and almost absolute. Appendix XIII.

Water Cartridge.—Mr. Dickinson knows of no defect in the water cartridge, but the other witnesses who have spoken about it agree in condemning it as troublesome to use, and on that account a source of danger. Mr. Stokes mentions two failures in his district. The explosions at the National Colliery, and Apedale, were both caused by the careless way in which water cartridges were used. Dickinson, 1410. H. Hall, 471. Galloway, 1060–1062. Bell, 1657. Stokes, 3105. Ashworth, 4685. Morgan, 4837. Wilkinson, 5584.

Lime Cartridge.—The lime cartridge is not much in use. With some kinds of coal it fails to act satisfactorily. In other cases, Sir F. Abel thinks there is an unreasonable prejudice against it. Mr. Stokes, however, considers it practically of little value. Abel, 2424, 2425. Stokes, 3098.

On a review of the whole of the evidence on this point, we have come to the conclusion that, whatever minor objections may be established against the use of high explosives, their general employment would greatly limit the risk of explosion in dry and dusty, and in fiery mines.

Having regard, however, to statements which have been made by several witnesses that the abolition of the use of gunpowder would stop the working of many collieries, and bearing in mind the great variety of conditions under which different mines have to be carried on, as well as the various qualities and quantity of dust, and the method of working, we do not feel justified in recommending the universal abolition of the use of gunpowder.

On the other hand, we think that the conclusive proof which the evidence has afforded of the great additional danger caused by the use of gunpowder justifies a considerable advance in the direction of the abolition of the use of gunpowder in dry and dusty mines unless a sufficient and effectual means of watering the dust be systematically carried out.

Section 42 of the Coal Mines Regulation Act, 1887, provides that :—

"If in any respect (which is not provided against by any express provision of this " Act, or by any special rule) any inspector finds any mine, or any part thereof, " or any matter, thing, or practice in or connected with any such mine, or with the " control, management, or direction thereof by the manager to be dangerous or " defective, so as in his opinion to threaten or tend to the bodily injury of any " person, he may give notice in writing thereof to the owner, agent, or manager of " the mine, and shall state in the notice the particulars in which he considers the " mine, or any part thereof, or any matter, thing, or practice to be dangerous or " defective, and require the same to be remedied; and unless the same be forthwith " remedied shall also report the same to the Secretary of State."

The section also provides for arbitration in the event of the owners, agent, or manager of the mine, objecting to carry out the requisition of the inspector.

Under this section it is already possible for an inspector to require the discontinuance of the use of gunpowder, but it has been suggested that the section was intended to apply only to exceptional cases, and not to remedy conditions of risk which may apply to a large number of coal mines now at work.

In order to remove any doubts on this question, we recommend that by further legislation, power should be given to the Secretary of State to prohibit the use of gunpowder in the case of every mine which is either fiery, or dry and dusty, unless sufficient and effectual means of watering are carried out. As, however, it is not possible at the present time to lay down a stereotyped definition of what constitutes a fiery mine, or a dry and dusty mine, it will be necessary to allow of some discretion in cases where the decision of the Home Office upon this point may be reasonably disputed by the owners of the mines affected.

We recommend, therefore, that on the passing of such an Act as we have suggested, the Secretary of State should prepare a list of mines to which the provision should apply, and that notice should immediately be given to all the owners of such mines, and that they should be required within 12 months to carry out the requisition.

The Secretary of State should also be empowered to add to this list from time to time whenever he is satisfied that any mine, not previously on the list, should be subject to the same provision.

If any owner objects on the ground that his mine is not properly described as a fiery mine, or a dry and dusty mine, or that the means provided for watering are sufficient

protection, we recommend that he should have power to appeal to a temporary Commission to be appointed by the Act in order to deal with such appeals. The Commission should be empowered to take evidence, and, if it thinks fit, to examine the mine, and to decide finally whether in its opinion it is desirable in the interests of safety to life that special precautions as to efficient watering should be put in force in the mine or that the use of gunpowder should be discontinued, and the requisition of the Home Department should then be either affirmed or withdrawn according to the decision of the Commission.

Where an exemption shall have been granted by the Commission, and subsequent to such exemption, an explosion takes place which can be reasonably attributed to the use of gunpowder, in the mine exempted or any neighbouring mine, the Secretary of State should have power to place any such mine on the list of those to which the provision for the abolition of the use of gunpowder applies.

The evidence taken by us as to the action of different so-called flameless explosives leads us to believe that several of them may be practically safe for all purposes, and it is probable that the experiments now being carried on by the North of England Institute of Mining Engineers at Hebburn will throw additional light on the subject; besides which it is probable that, from time to time, the progress of invention will produce new explosives of equal or greater merit, and we recommend that all explosives used in mines should, after examination and experiment undertaken by the Home Office, be from time to time certified by the Secretary of State for the Home Department as proper to be employed for the purpose.

We are of opinion that the practice of using bituminous shale, or other material containing volatile inflammable matter, or of clay mixed with coal dust, increases the danger from blasting. At Apedale Colliery a bituminous shale was used for stemming the shot which blew out and caused the explosion. General Rule 12, section *d*, of the Coal Mines Regulation Act, 1887, prohibits the use of coal or coal dust for tamping. We have heard from witnesses that it is a common practice in some districts to use shale, or under-clay mixed with coal dust, for tamping shots. We think that the rule should be made more stringent, and should declare that all tamping should be done with clay or other non-inflammable substances.

Bell, 1571–1587.

The adoption of these recommendations will, we believe, have the effect of reducing to a minimum the danger of explosions in non-fiery mines, by preventing the initiation of an explosion by blown-out shots acting on an accumulation of coal-dust.

There will remain, however, the risk of an explosion of gas in a fiery mine which might be initiated by a naked light, or even by some of the so-called flameless explosives, and carried on and intensified, so as to be much more dangerous than it otherwise would be to life and property by clouds of coal-dust raised by the first and continued by subsequent explosions. Such a danger is of course greatest in dry and dusty mines, and we have taken much evidence as to the best means of obviating it.

Galloway, 1064–1068, 1220–1224. Garforth, 5824. Garthwaite, 6415.

Dust-tight tubs have been suggested in order to prevent the accumulation of dust in the haulage roads. In cases where the condition of the strata makes watering a difficult and dangerous operation, such waggons would, it is said, alleviate the evil, and tend greatly to keep these roads free from dust. To introduce them into collieries already being worked would, it is admitted, very much limit the output.

H. Hall, 558–561. J. B. Atkinson, 965–968.

Dust from the Screens.—A large quantity of dust is carried down by the ventilation from the screens into the intake air courses. This does not, however, appear to be a matter which can be easily remedied, and neither Mr. H. Hall nor Mr. J. B. Atkinson is able to make any suggestion.

H. Hall, 289–291.

The removal of the dust has also been advocated by various witnesses, and no doubt in many cases the danger may be lessened by this means. In some instances the dust might be got rid of, but there are many collieries where removal is entirely out of the question.

J. B. Atkinson, 679–681. W. N. Atkinson, 2279. Stokes, 3069. Morgan, 4822, 4897. Isaac, 4947. H. W. Martin, 5371. Hood, 5951. Austine, 4323–4326, 4340–4354, 4370–4385, 4400. Appendix III.

The witnesses are almost unanimous in agreeing with Mr. Hall that removal is not an effectual remedy, although it has been urged that as far as possible it should be resorted to even when further precautions are taken.

This opinion is confirmed by the report of the Austrian Commissioners, who say that sweeping out the dust where shots are fired is troublesome, and will rarely be properly carried out.

Watering.—While recommending that every effort should be made to prevent undue accumulations of dust, it appears to Your Majesty's Commissioners that the only effectual way of dealing with this source of danger would be a satisfactory system of watering and thoroughly wetting it.

This precaution is already largely adopted in Durham, South Wales, Staffordshire, Yorkshire, and Derbyshire. In other districts little damping appears to be done.

Lushington, 122, 139.

It is alleged by many witnesses from various parts of the country that watering would cause serious trouble in the roads by loosening the strata, and thus bringing down the timbers and roof and lifting the floors.

"If we watered any of those haulage roads, it is possible some morning, when we expected to get 1,000 or 1,100 tons in the day, the pit would be stopped by falls of roof."

W. N. Atkinson, 2280. Lishman, 1737–2906. Lucas, 3226. Longden, 3437. Garforth, 3757. Bedlington, 5699.

"That would take place once for all, I presume, would it not?"—"No; it would be constantly falling." "After it had been watered it would fall, I suppose, within a day or two?"—"Yes." "And then further watering would not matter, would it?"—"Yes, it would bring more down."

Garforth, 3884–3887.

On the other hand, it is said that this danger only exists when too much water is used. All that is necessary can be done without such consequences. Mr. Galloway maintains that it is only the sudden change of temperature which causes the difficulties with the roof and floor, and that the falls of stone, &c. cease after a day or two.

Galloway, 1159, 1160. Bell, 1671. Burrows, 4081. H. W. Martin, 5415, 5416. Hood, 6015.

Mr. Austine, speaking of the Cadzow Collieries, in Scotland, says that he does not find that the fire-clay bottoms "melt" with the quantity of water which he finds necessary.

Austine, 4383.

If the strata allows it, Mr. Lucas thinks watering when effectively done a safeguard, but it is impossible to get watering tanks into the return aircourses in extensive workings.

Lucas, 3229, 3230.

It is maintained by Mr. H. Hall, Mr. Stokes, and Mr. Ashworth that it is a very difficult matter to saturate the dust. "The water runs about on the dust, and it "does not get into it at all: if you just rake it up a bit you find the dust quite "dry under where they put the water; it is difficult to saturate it."

Stokes, 3068–3070, 3113, 3114. Ashworth, 4643. H. Hall, 311.

Mr. Stokes thinks that watering in the roadways would slightly affect the intensity of an explosion, but possibly the whole of the dust might rise up and ignite in spite of the film of dampness on the top. Watering he considers is not a sufficient remedy. "The remedial measures must be looked for in the initial start of the explosion; stop "the explosion, stop the shot-firing, stop the gas explosions, and you need not take "any notice of dust so far as colliery explosions go."

Stokes, 3069.

On the other hand, other witnesses contend that watering is quite practicable, and that when once saturated the dust is kept in a damp state with little trouble.

J. B. Atkinson, 682–690. Galloway, 1084–1089. W. N. Atkinson, 2280. Morgan, 4091. H. W. Martin, 5386, 5387. Wilkinson, 5552, 5553. Thomas, 6248.

Mr. Hood, speaking of the roads referred to by Mr. Stokes in his evidence on this point, states:—

Hood, 5996.

"I have had the dust analysed for moisture. "The natural moisture in that "coal is ·80 per cent., and the moisture in the dust so found (by Mr. Stokes) on "this plane was 1·84 per cent."

Mr. Morgans in reply to the question, "You do not wish to detract from the "danger of coal dust"? replied, "Not at all, and I think those precautions for "watering the dust are most valuable."

Morgans, 1844.

In addition to damping the floor, Mr. J. B. Atkinson and Mr. W. N. Atkinson maintain that it is necessary to water the roof and sides of the roads with a hose.

J. B. Atkinson, 796. W. N. Atkinson, 2284.

On the contrary, others are of the opinion that to water the floor is all that is necessary.

Galloway, 1148–1151. Austine, 4370.

Other witnesses would confine watering to the main haulage roads and the working faces, and other places where there is a special accumulation.

Galloway, 1157, 1161, 1162. Lishman, 2911. Forman, 5080–5082.

Many witnesses advocate the watering of the roads quite as much as a sanitary measure as a preventive of explosions. No evidence has been given to show that the miners object to the practice; on the contrary, it is said that they find that it makes the mines cool and more comfortable to work in.

Dickinson, 1418. Moore, 2619. Lishman, 2788, 2873. Stokes, 3069. W. F. Hall, 3546. Garforth, 3757, 3896. Burrows, 4121.

Whereas it may be impossible to maintain the whole of the roads in a thoroughly damp state, it is urged that parts of the main roads might be kept damp enough to arrest the course of an explosion, and thus confine it to a section of the mine.

Morgan, 4840. H. Hall, 303. Ashworth, 4643.

The length of such damp patches to serve this purpose should be, it is estimated by various witnesses, from 70 yards to 200 yards.

J. B. Atkinson, 801. Galloway, 1169. W. N. Atkinson, 2275.

J. B. Atkinson, 803. "I do not think that even where the explosion is very violent, the flame extends "much beyond where the inflammable material ends."

Forman 5118. Mr. Forman believes that a few yards of wet ground would stop an explosion.

Appendix XIII. The Austrian Commissioners reported that watering was undoubtedly useful, but would not guarantee thorough safety unless all the roadways and working places, including the roofs and sides, were watered. Such a watering, however, could not be effectively carried out without very great, and in some cases, insurmountable difficulties.

Hood, 5959–5964. Thomas, 6248. Hood, 5965–5989, 5996, 6014–6017, 6037–6039. *The Spray System of Damping.*—In some of the South Wales mines perfect saturation of the atmosphere is said to be obtained by a system in which the mere pressure of the water is sufficient to produce a spray. Among other mines, this system is in operation in those belonging to the Glamorgan Coal Company. A pressure, sufficient to secure a thorough division of the water is essential, and in the case described by the general manager of these collieries, the average pressure per square inch is 330 lbs. The number of the jets depends entirely upon the size of the road and the quantity of air passing. In the collieries in question, it appears that the jets are placed about every 40 yards in the main roads, while the average velocity of the air is 8 or 9 feet per second. In the intake and the return the sprays are kept continually going, but in the working places, where thorough saturation of the air would render it unpleasant for the men to work. the sprays are only turned on for two hours at a time.

Three diagrams were displayed showing the humidity in the air: (1) when the jets had been idle for four days, (2) when the jets were playing and the surface temperature was nearly normal, (3) when the jets were playing in frosty weather.

In Case 1, the weather at the surface was cold and foggy with 88 per cent. humidity in the air, and throughout the workings 80 per cent. was about the highest humidity that was registered, while there was a difference of four degrees between the dry and the wet bulb.

In Case 2, when it was raining heavily at the surface, practically complete saturation was obtained, the dry bulb registering 50, and the wet bulb 49½.

In frosty weather the spray is not so effective, and it appears to be impossible to obtain complete saturation of the air. This is shown by Case 3, taken with a temperature of 31° at the surface. 91 per cent. of humidity was the highest obtainable, and it is said that this is not sufficient for the main roads which should contain 100 per cent. of moisture. When the weather is frosty recourse is had to a steam jet, which is placed at the top of the downcast, for the purpose of serving as an auxiliary to the water jets.

Morgan, 4839. H. W. Martin, 5369. Wilkinson, 5552, 5553, Hood, 5959. Appendix XI. *The Spray System with Compressed Air.*—The spray system, in conjunction with compressed air, is highly spoken of by Mr. W. N. Atkinson, Mr. H. W. Martin, Mr. Wilkinson, and other witnesses from South Wales, where it is in operation in several mines. After an inspection of it at the South Tunnel Pit, belonging to the Dowlais Iron Company, Mr. W. N. Atkinson, says:—

"There are about 1,200 yards of pipes in use on engine plane and horse haulage "roads. The sprays are from 40 to 100 yards apart.

"The compressed air is at a pressure of from 35 lbs. to 45 lbs. per square inch. "The compressed air has a marked effect, and produces a much finer spray than I "have ever seen caused by water alone, even when under very high pressures.

"The distance for which a spray is effectual for damping the dust also appears to be "greater than when compressed air is not used. There was a very large amount of "the finest coal-dust on the upper surfaces of the engine plane, and much coal-dust "and débris on the floor. The effect of the sprays, as I observed it on this road, was "in my opinion adequate to prevent the passage of an explosion by coal-dust. At odd "places a little dry dust could be found where it was shielded from the action of the "moisture, but the great bulk of the dust was so thoroughly moistened that I believe "the passage of flame due to coal-dust would be impossible.

"The time during which the sprays should be kept in operation, and the intervals "which may elapse without them, will require careful attention, but I am strongly "inclined to believe that they can be made effectual to prevent the initiation or "extension of an explosion by coal-dust."

H. W. Martin, 5405–5409. It is said to be inexpensive to apply.

Wilkinson, 5554. Mr. Wilkinson thinks that the saturation of the air with moisture is of such importance that it should be automatically maintained.

Bell, 1669, 1672, 1673. Mr. Bell prefers the spray system of watering. He mentions that it is in use at Ryhope Colliery, and that it reaches every part of the road and the tops of the

timbers. He suggests that it might be made compulsory to water every main haulage road once a week.

Mr. Garforth points out that it is impossible to reach the roof with sprays where the falls are 18 feet high, and that in a large colliery some of the dust would on this account remain in a dry and dangerous condition. Garforth, 3757, 3782.

Mr. H. W. Martin states that the spray system lowers the temperature, and is therefore an advantage. He adds that although the dust in the mines under his charge is mixed with shale and stone dust, and is accordingly more or less innocuous, he yet considers it necessary to water, although he does not accept the theory that dust can initiate an explosion. He says, "I would not trust dust at all under any conditions, "without damping it." H. W. Martin, 5366–5371, 5425.

Mr. Hood, speaking of the spray system, would only apply it to mines where the heat was great, in order to cool the atmosphere, and does not consider it necessary to prevent explosions. Hood, 6011.

Mr. H. Hall and Mr. Isaac consider that the spray system, as employed in South Wales, is effective in main roads, but object that it leaves the working faces untouched, which in Lancashire, Mr. Hall says, are very dusty. H. Hall, 460–465. Isaac, 4947, 4949, 4978.

Mr. J. S. Martin, while regarding watering by the spray system as practised in South Wales as a highly desirable and necessary precaution, does not think it totally effective. J. S. Mart 6606, 6643–6650.

We have carefully considered the evidence on this question from all sides, and while we are of opinion that the only sufficient precaution hitherto suggested against the dangers of coal-dust in fiery mines is a complete and satisfactory system of watering, we also feel that the same reasons which have prevented us from recommending an universal and stereotpyed rule in regard to the use of gunpowder, apply with equal or even greater force to the provision of expensive and probably complicated systems of watering.

We are, therefore, of opinion that in any case in which the inspectors think it desirable, in order to ensure the safety of life, they should use the powers given by section 42 of the Act of 1887 to declare that the provision for watering the dust in a mine is insufficient, and to require such further arrangements to be made for this purpose as they may prescribe.

If the owner of the mine objects to carry out these requirements, he will have the right of appeal in accordance with the provisions of that section.

In any case in which a sufficient provision for watering the dust, approved by the inspector, has been made, either voluntarily, or in consequence of such a requisition as is above referred to, we think that the owner of the mine may be relieved of the obligation to discontinue the use of gunpowder.

We also recommend that the following precautions (already partly provided for in the existing Mines Acts) should receive the special attention of those responsible for the management of coal mines :—

1st. That the firing of shots should be carried out between the shifts and when the majority of the men are out of the mine.

2nd. Where general watering is not prescribed by the inspector, that the roads on either side of the place where a shot is fired should be thoroughly wetted for a space of at least 30 yards, and

Lastly, that large accumulations of dust, whether on the roof or floor, should not be allowed to remain.

All which we humbly submit to Your Majesty.

(Signed) J. CHAMBERLAIN.
RAYLEIGH.
W. THOMAS LEWIS.
H. B. DIXON.
EMERSON BAINBRIDGE.
CHARLES FENWICK.

JOHN WILSON,
Secretary,
June 13th, 1894.

MINUTES OF EVIDENCE

TAKEN BEFORE THE

ROYAL COMMISSION

ON

EXPLOSIONS FROM COAL DUST IN MINES;

WITH

APPENDICES AND INDEX.

VOL. II.

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MINUTES OF EVIDENCE

TAKEN BEFORE THE

ROYAL COMMISSION

ON

EXPLOSIONS FROM COAL DUST IN MINES.

At 23, Great George Street, Westminster.

TWELFTH DAY.

Friday, February 12, 1892.

PRESENT :

THE RIGHT HON. JOSEPH CHAMBERLAIN, M.P., CHAIRMAN.

Lord RAYLEIGH.
Mr. CHARLES FENWICK, M.P.
Mr. EMERSON BAINBRIDGE.

Professor HAROLD B. DIXON.
Mr. J. WILSON, *Secretary*.

Mr. JAMES ASHWORTH called and examined.

Mr. J. Ashworth.

12 Feb. 1892.

4597. (*Chairman.*) You are a mining engineer, I think, at Morley, in Derbyshire ?—I am.

4598. Has your attention been directed to the question of the influence of coal dust in explosions ?—It has.

4599. And where was it first directed to the subject ? —In North Staffordshire.

4600. Was it brought to your notice by practical experience of explosions, or in what way ?—It was by explosions, beginning in the year 1875.

4601. Will you tell us about these explosions and what conclusions you arrived at in respect to them ?—I think the explosion that took my notice most particularly was that at Swaithe Main, at Barnsley, in 1875. There I went down the pit, and I saw the condition of the pit.

4602. What was the state of affairs there ? The mine had evidently been considerably disturbed, and there was a great deal of dust about, and one would think it was coke dust; it was very fine dust, and a great deal of damage was done. The part of the mine that I particularly inspected was a part called the slant level and the slant drift level; and there there was evidence of the explosion coming down a place from the top side of the level, and then apparently splitting both ways, both inbye and outbye.

4603. Did you come to the conclusion that this explosion was caused by coal dust ?—I came to the conclusion that the explosion was caused primarily by the failure of a safety lamp. I thought so at the time.

4604. By a safety lamp firing gas ?—Originally by a safety lamp passing the flame through the gauze in a current containing fire-damp and suspended coal dust.

4605. Did the explosion extend over a considerable space ?—Over the whole of the pit down below the pit level.

4606. Do you think it was carried on by coal dust ?—Yes, decidedly.

4607. In your opinion, then, this was an explosion to which gas and coal dust contributed ?—Yes, gas and coal dust together contributed.

4608. (*Mr. Fenwick.*) What class of safety lamp was it ?—It was a Stephenson's safety lamp. I believe they were used there all through. There were some Clannys, I believe, but in this particular district, I believe, they were all the Stephenson lamp.

4609. (*Chairman.*) Is there any other instance to which you wish to direct our attention ?—Then there was another case of a blown-out shot at the Sheriff Pit, Silverdale, in 1878. In this case the disaster did not go all the way through the mine, although it was a case of a very heavy blown-out shot. One man was killed and two boys were smothered by the dust, but the latter were not burnt at all.

4610. How was it that the explosion was not continued throughout the whole of the mine ?—I think in that case that the dust that was in the air carried the flame to some extent, but it did not explode; the dust itself did not explode, and I do not think there was any quantity of gas found. I inspected the place myself after the accident, three or four days afterwards, and I found no gas whatever. I could not find a trace of gas.

4611. Then you think that the explosion, as far as it went, was partly due to coal dust ?—I think that the very fine coal dust present in the air contributed to carry the flame from the blown-out shot some considerable distance. I think the distance to where the miner was burnt and killed was about 60 yards, and I think that the flame, assisted by the dust floating in the air, was carried from that blown-out shot to that distance.

4612. Did you notice anything which was likely to have arrested the explosion at that place ?—Nothing at all.

4613. There was no wet place ?—I do not remember seeing any wet place at all. It is a very dry mine.

4614. That was at Silverdale ?—Yes.

4615. In what seam ?—The 8-feet Banbury seam.

4616. (*Professor Dixon.*) That is a dry seam ?—Yes.

4617. (*Chairman.*) Then is there any other explosion which you have had experience of ? —I have investigated two other accidents. I investigated one last year at the Ashton Moss Colliery; that was a blown-out shot, in which there were two men killed.

4618. And was coal dust concerned in that ? —I do not think the coal dust ignited any more than it did in

Mr. J. Ashworth.

12 Feb. 1892.

the case at Silverdale. I do not think there is any evidence of a coal dust explosion there. It was a very dry mine.

4619. What was the second one?—The next one was at Sladderhill, in North Staffordshire.

4620. I think you have omitted one to which you intended to refer, the Wood Pit, at Haydock?—Yes.

4621. Will you just deal with that first, then?—In that case I think the explosion was caused by a Davy lamp, and that the coal dust there decidedly did explode, but that was accelerated by and mixed with fire-damp. I think it was fire-damp there. I do not think it was dust by itself.

4622. Now, speaking generally, do you think that the part played by coal dust in explosions is important enough to justify special attention?—Yes, I do. I have not seen the Elemore Colliery, in the north, but I assume the Elemore Colliery and the Altofts, which I have seen since the accident, were decidedly coal dust explosions, and without any admixture of fire-damp whatever. I do not think there was any fire-damp whatever in those two cases.

4623. These explosions are initiated generally, are they not, by the explosion of a shot?—The Elemore Colliery and the Altofts were both originated by a shot. I assume the Llanerch Colliery explosion in South Wales to have been originated by a small explosion of gas and carried on by the dust; and that it was mainly a coal dust explosion.

4624. Dealing first with the explosions which are due to blown-out shots, have you studied the question of explosives generally?—I have.

4625. What is your opinion, in the first place, with regard to, say, gunpowder in blasting?—I have taken great interest in gunpowder, especially some few years ago, and I have read several papers before the North Staffordshire Institute. I had a table prepared by Dr. Carnelley then of Owen's College, Manchester. I specified for certain quantities of coal dust and aqueous vapour and fire-damp, and a certain weight of gunpowder, and that the shot should be a blown-out shot. I asked him to calculate the chemical effects on the atmosphere all the way through. I have here the tables that he prepared. First of all he gives the chemical composition of the atmosphere before the explosion. Then he takes the atmosphere after the explosion, and also the atmosphere that was finally left after the fire has returned, that is the explosion goes outwards, and then the fire burns backwards, burning the carbonic oxide, thus showing finally the atmosphere created by the explosion—the probable atmosphere created by an explosion in which fire-damp a blown-out shot and the ordinary condition of a mine are taken into account. (*Handing in table. See Appendix* XIV.)

4626. What object had you in view in making these calculations?—The object was to show that if you used a powder of good quality, that is the very best powder that could be produced, and a powder of a certain density, and that powder was fired by a detonator, you could fire then with almost absolute safety, whereas if you used a common powder you were almost certain to have a disaster. The powder that I have been taking most interest in, and the powder that I believe is a safe powder is one, I think, only manufactured by Curtis and Harvey, called E.S.M.—extra strong mining—I believe that is the interpretation; however, it goes by the initials of E.S.M. That powder detonated is, I know as a practical fact, from three to four times as strong as ordinary blasting-powder. The composition is something similar to the powder used by the Government for cannons, ordnance work; but the powder is not so dense. In fact it is not a dense powder at all, and the consequence is that if you fire that powder by a detonator each grain of powder is practically ignited at the same instant. The consequence is that if you get a blown-out shot you get no particles of the powder blown out unconsumed; each grain of powder is consumed. I have used that powder myself under certainly dangerous conditions, and I never had a single accident in any shape or form, and never had a blown-out shot with it.

4627. Assuming the use of this powder in a mine in which gas prevailed, do you mean to say that a blown-out shot with it would not be dangerous, that it could not explode the gas?—I think it would be very difficult to get a blown-out shot; but if you got a blown-out shot with that powder, I would not say that you would not get somewhat of a disaster because you get a flame, but each grain of powder being ignited at the same instant of course the condensation of those gases and the cooling of those gases takes place immediately, and if the ramming or stemming gives way then the condensation is going on and the cooling of the gases is going on the whole of the time, the only question is, of course, whether those gases are cooled down sufficiently by the time they get outside the borehole as not to ignite fire-damp. It is proved now that if you can reduce the heat of the explosive by the time it gets outside the hole under, I think, 2,732 degrees Fahrenheit, then you cannot ignite the gas; so it appears that if you can get gunpowder even or any other explosive and can absolutely say that by the time the heated gases get outside the hole the heat is reduced down under that figure, you will have no disaster.

4628. Are you aware whether there have been any experiments to show whether this powder can or cannot explode gas?—I have made experiments myself, of course in the ordinary course of working; but no experiments to show (that is in a tube or any prepared gallery) that any required effect would result.

4629. You could not say, then, as a matter of absolute certainty, that even with this powder gas might not be exploded, and a general explosion set up?—No; I cannot say so. I do know this, that in consequence of the present investigations going on into explosives, Curtis and Harvey have got the matter before them at the present time, and, I believe, will certainly bring that same powder out in a little different form, but so constructed, and so protected, that when the gases get outside the borehole the heat will be so reduced that it will absolutely not fire gas, providing, of course, the hole is stemmed. You must have the hole stemmed. I do not think any explosive—I do not mind which explosive it is—is safe without stemming on it, not any of them. Every explosive depends for its safety entirely, all the high explosives at any rate, on the strength of the detonator. If the strength of the detonator is weak or the composition of the explosive happens to be altered a little bit, and detonation is not complete, you get a flame and you are as liable to have a disaster with a high explosive if it is not properly detonated as you are with the best gunpowder.

4630. Have you any practical suggestions to make then with regard to detonators or with regard to stemming?—I think the most practical suggestion that I should make is that taking ordinary gunpowder as it is generally used in a hole with a diameter of from $1\frac{3}{4}$ inches to two inches, generally the whole is practically of two inches diameter, that every explosive should be used in a hole of reduced diameter in proportion as it is stronger than gunpowder. For instance, if you take E.S.M., this extra strong mining powder, as an illustration, if you use the ordinary powder in a two-inch hole I should use the E.S.M. in a hole not more than an inch and a quarter in diameter. The practical effect is this, that if you get a hole of a certain length we will say, supposing the powder fills up the hole to the length of 12 inches you have a 12-inch leverage. Then if you get a stronger explosive, I say that that stronger explosive ought to be laid along the hole for 12 inches, or ought to rest along the hole for 12 inches if it is to be compared in strength for coal getting with gunpowder. There is another advantage in it also, that if you take an inch and a quarter diameter hole compared with a two-inch hole you have a greater superficial area here in an inch and a quarter than you have in the two-inch for the same weight of powder.

4631. How does the reduction in the size of the hole lessen the chance of explosion?—It lessens it in this way, that a smaller length of stemming then secures the charge. Sir John Burgoyne in a little book that he published on blasting and quarrying proves that two ounces of powder in a two-inch hole will blow out not more, I think, than 20 inches of the best clay stemming, the best stemming that you can put in. He tried several shots, and two ounces would not blow out more than 20 inches of stemming. Then if you get the same weight of powder in an inch hole, seven inches of stemming will hold the same strength of powder, seven inches will hold it secure. It will not blow out more than seven inches of stemming.

4632. I suppose the larger the hole the looser the stemming, and consequently the easier it is pushed out?—The diameter, and of course the area on which the pressure comes, is larger in the two inches than it is in the one. The French Commission have made some experiments upon that, and I think, if I remember aright, they issued a decree that no shot should be fired

without a certain depth of stemming on the top of it; not less than 20 inches.

4633. But your idea is, that the strongest possible explosive should be used, and in a proportionately smaller diameter of hole?—No, I do not quite say so. I do not say that you should use the strongest explosive. I say, supposing that the explosive that you use is four times the power of the ordinary powder used, I should reduce the diameter of the hole in proportion; I should only make the diameter of the hole one-fourth of that used for the powder. So that whatever explosive you used, you would reduce the diameter practically in accordance. I think it is hardly practicable myself to get the hole much under an inch; I think about an inch would be about the smallest diameter I should use, but still you can bore an inch readily. Then, of course, for the question of safety, you must be particular that the quality or the sort of stemming that you use is not coal dust, nor the same as was used in the Sladderhill case—a blackberry dirt—I think they called it blackberry dirt. That blackberry dirt would, of course, cause a flame of itself.

4634. Is there any other suggestion you have to make with regard to explosives?—I think that as far as the use of explosives is concerned, it is very important that the explosives should not be used in any case where you have ropes or chains, or rails, or signal wires anywhere in the line of fire.

4635. Why?—For this reason. I find in investigating the accidents, we will take, for instance, three of them as cases that might be followed out and the facts investigated and also discussed fully (those are the Elemore, the Altofts, and the Sladderhill cases), in all those cases we have ropes or chains or pipes and signal wires all present. My own opinion is, that in those cases the friction and the heat of the explosive blowing out across these various ropes and chains and rails and so forth, set up an electrical condition, and that it is the electrical condition which is set up which disturbs the dust all along the roads.

4636. Is not the concussion sufficient to disturb the dust, without any theory of that kind?—I think not; because if you take cases in which you have had blown-out shots in mines equally fiery, and equally severe blown-out shots, you have had no general disaster throughout the pit. I think if you compare those cases together, that you have a complete proof that there is a certain effect produced in the cases I have mentioned which is not produced in other cases.

4637. On the other hand, in the experiments which have been made, an explosion has been set up without any of those conditions, showing, does it not, that coal dust alone may be exploded by a concussion?—Yes; but I think that in all the experiments that I know anything at all about, the coal dust has been fed into the test apparatus, whatever it may have been, in such a quantity, that if you were in it yourself you could not breathe at all. That is not the ordinary condition of a mine. The ordinary condition of a mine is, that you have a certain amount of coal dust floating in the air, which we will take it is the very finest coal dust you have got. It is proved by the experiments of Mr. Garforth and his microscopical tests, that that coal dust is of a peculiar nature. If I remember rightly, from Sir Frederick Abel's experiments, the coal dust that was explosive was the coal dust which had the smallest specific gravity, and, therefore, that shows that the very fine coal dust must be something different from the ordinary coal dust that we find in a mine. I take it, judging from Mr. Garforth's experiments and his investigations, that each particle of that fire coal dust we see floating in the air, very probably if it were collected and put under the microscope, would be proved to have those little cells, those little spores, each spore being surrounded with a certain small cavity, and that it is that cavity which really makes the difference in the specific gravity. That is my view of it.

4638. Now, I think you are of opinion that the question of safety lamps is also an important one in considering this subject?—I consider that it is a very important one. In 1879 I was asked by the North Staffordshire Institute to come over from Wigan to start their experiments in safety lamps and put them in a way of getting them carried through, and on the 3rd September 1879 I went over there, and when I got there the illuminating gas that they had at command was not sufficient to foul a 10-feet current. The consequence was that if we were to conduct the experiments at all, we must resort to some other means of endeavouring to get an explosion. With that object we took some of the 8-feet Banbury dust from Sir George Elliot's Collieries at Harecastle, and that was spread on the floor of the test tube. The test tube had an area of 12 inches by 6, and I should think that it would be about 20 feet long, and coal dust was just spread on the floor of the tube. We started with a velocity of about 370 feet per minute. Then, to test what the condition of the atmosphere was before the lamp was put in, we had one of Ansell's fire-damp indicators. This was put into the tube to test the per-centage of gas. The per-centage of gas was, I believe, generally speaking, about 4½ per cent., which, of course, was of no use to explode the lamp in by itself; in fact, we did not expect to get an explosion. However, that was the extent of the fouling of the current by fire-damp. We then put a Davy lamp into the tube, and that Davy lamp failed (very unexpectedly, I may say) in 20 seconds. This Davy lamp had on the intake side a shield, the ordinary tin shield that was generally used at that time, and the lamp failed with a velocity of 370 feet in 20 seconds.

4639. What did that show?—That showed that a Davy lamp in the presence of coal dust, the coal dust being simply licked up from the floor of the tube, was unsafe. We had no coal dust disturbed in any way at all except by this small velocity. The consequence was that the coal dust we had in the air there would fairly represent the coal dust that you would find in an ordinary dry and dusty mine, such as Altofts. We went on then to make further experiments——

4640. You were saying what the failure of the lamp showed?—The lamp showed this: that if it were present in an ordinary mine and you had, we will say, 4½ per cent. of gas, and if the man had his lamp hung up in the ordinary way, he would never perceive that there was anything wrong with it, he would not perceive that 4½ per cent. of gas if it were behind him and he were working; he would go on working without taking any notice of it, probably, but if suddenly anything that happened should disturb the dust, and he want his lamp, that lamp would fail in 20 seconds. As a practical application of this, I may go on to say that I consider the Haydock explosion at the Wood Pits to have been caused in this way whilst a man was cutting a thirling through between two levels. If I remember correctly, this man was found blown through a small cutting that he had just nicked through between two levels. The air previously to his nicking through had gone along the level, then back again along the bratticing, then down a thirling, then up another level, and then back again along the bratticing. The consequence was that as soon as the thirling was cut through the whole ventilation would pass through it, and as the lamp would be on the cutting side and in the direct line of the dust and the air, as soon as ever he nicked through the extra ventilation would disturb the dust behind. The gas present in the air (and there is very little doubt there was gas present in the air there) combined with the dust, carried the flame through the lamp, and started that explosion. That is my view of it. I think also that one of the accidents at Leycett (I do not remember the date of it) was caused in a similar way. You may remember that in that case there was a man working in a place where an air-pipe ventilated a heading; it was not a case of a bratticing, it was a case of an air-pipe blowing on to his lamp. I think that that case was also an instance of a small per-centage of gas combined with coal dust. Shall I go on and state the other tests that we made at Harecastle in September 1879?

4641. If you please?—The next test was with a Davy lamp, and that fired in seven seconds in the same velocity. The next test was with a Clanny lamp, and that fired in 25 seconds; and each time the explosion happened the coal dust on the floor of the tube was ignited. The next test after that was a Davy lamp in a velocity of 570 feet per minute, and that exploded in four seconds; in that case the shield was down on the return side, the opposite side to the first experiment. The next test was with a Davy lamp with a double gauze, and that exploded in 3 minutes 47 seconds. The next lamp after that was a Williamson, in a velocity of 570 feet, and it exploded in 55 seconds; the shield in this case was on the return side at the top of the gauze. The next test was also with a Williamson and in a velocity of 580 feet per minute, and that exploded in 55 seconds; the shield was on the opposite side, the intake side. The next test was with a Clanny, in a velocity of 580 feet per minute, and that exploded in 35 seconds. The next test was with a Stephenson lamp,

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in a velocity of 580 feet per minute, and that exploded in 42 seconds. The last test was made with a Gray, the velocity being 580 feet per minute; the gas continued to burn, and the experiment was suspended; that lamp did not fail; it was the only one that did not fail out of the lot.

4642. What precautions, then, do you think it is necessary to take to prevent the failure of the lamp?—I think it is necessary with every safety lamp, if the mine is a dry, dusty mine, giving out fire-damp, unless the gauze is specially protected, that that lamp should have two gauzes. For instance, where a Clanny lamp is often used it ought to be a lamp of the Marsaut type, that is, with two gauzes, or the gauzes protected in such a way that the air of the mine and the dust cannot impinge directly on to the gauze. As actual instances of the failure of lamps under conditions similar to those tested at Harecastle, I give that of the Morfa Colliery in South Wales, where a lamp which is called a Marsaut lamp, but which was really a Clanny lamp, failed in a place called the Six-and-a-Half; and that of the Moss-fields Colliery in North Staffordshire where a Museler lamp failed in the north level of No. 15 jig.

4643. Now will you just name in their order the precautions which you think it would be desirable to take to prevent explosions by coal dust or connected with coal dust. In the first place, with regard to the working of the mine, do you consider that it is desirable to water the mine, for instance?—I do not think water is of any value whatever. If you were to carry out the present Act and water the places about a shot, you do as much practical good as you do if you pour water on to soot, and that is simply that it hangs about on the soot in a sort of little globules; the soot is not damp and the coal dust is not damp, and any watering that you do like that is of no value whatever. You will not prevent an explosion by watering; and the only value of watering, as far as I can see, will be in arresting an explosion by having thoroughly wet places in the road. You can have these thoroughly wet places in various parts of the mine, and you may be perfectly certain, or practically certain, from the experience of explosions, that the explosion will not pass those points.

4644. What lengths of wet ground do you think necessary to arrest an explosion?—As far as the actual proofs go, you are perfectly certain that 70 yards is quite long enough, and it is very probable that a good deal less than that will do.

4645. Then coming to the blasting process, what precautions do you say are necessary there?—First of all, the diameter of the bore-hole should be properly regulated, and in a dry and dusty mine the non-use entirely of ordinary black powder. The ordinary black powder is not of good enough quality. If you are to use powder you must use powder of the very best quality. If you use powder of the style of the E.S.M.—I do not know any other powder that I can compare it with; but if you use it of that class and detonate it (every shot should be detonated), I think that we shall then have got some measure of safety, or about an equal measure of safety to that which you will have with the ordinary high explosives.

4646. Have you anything to say as to the position of the shot;—Yes; I think that no shot should face the current, no shot at all should face a strong current; the stronger the current the greater the danger. As far as you can arrange it, the force of the shot should always go with the current.

4647. How do you consider that these explosives should be fired?—Electrically, always.

4648. I think you have already told us that you consider the diameter of the bore-hole and the question of leverage should be carefully attended to?—Decidedly. I think the question of leverage is most important. If you wish me to give a case, a case of which we have all the published facts, then Sladderhill is a very good instance. In that case the explosive only filled up, I think, about 2 inches or less of the length of the hole, and the hole with that length of explosive in it, was practically on the fast, and that shot blew out, and in blowing out blew this blackberry dirt out, and then the force of the flame which was created was fired into a mass of fine coal dust, and also crossed the rails and the pipe. I do not think that that accident would have been so severe if the shot had not acted, as I have just stated before, electrically on the rails and pipes before it, because the shot was distinctly in the line of the rails.

4649. Have you anything to say about the so-called flameless explosives?—I do not know really at present which explosive is flameless under all conditions. If tests are made on explosives, I should propose that they be tested with the bare fuse as well as with the detonator, simply because a shot fired with the bare fuse would represent a weak detonator; a weak detonator would have the same effect probably as a weak fuse, and the effect produced on a high explosive by a weak detonator is totally different from the effect produced by a detonator of sufficient power; in fact, in some cases it has been shown that part of the charge is detonated, and part of it is not detonated.

4650. Then in the present state of knowledge you would suggest that flameless explosives should be protected?—Yes, they ought to be protected.

4651. Have you considered the subject of further experiments for the purpose of determining some of the questions which are still in doubt?—Yes, I have.

4652. What conclusions have you formed upon that?—I have come to the conclusion that the proposals which have been made so far are simply repetitions of the experiments which have been made on the Continent, and experiments which have been made, I think, by the Chesterfield Institute, and on the general line on which experiments have been made heretofore, that is, in a straight gallery or tube. I do not know a single case in which they have had any velocity of air passing at more than 6 feet a second, I think at Chesterfield they had 6 feet a second. If you carry out experiments to prove anything you want a velocity corresponding with the known velocities in cases such as Altofts and Elemore, and Ashton Moss for instance, in which the velocity would range from 30 feet to 50 feet per second. In such a case the coal dust that will be put into the apparatus, whatever the shape of the apparatus, would be licked up by the wind as it went past, and would represent the ordinary conditions that you have in a mine. If you simply have an open tube, and you fire shots into it, then, I suppose, you would have to have, as Mr. Galloway said, a very fine coal dust and pour it in. Then you would show that you got an inflammation. I do not know that anybody disputes that. There are very few people who will dispute that coal dust will inflame or explode under such conditions. But that is not the condition of a mine. Therefore, I should propose that you have conditions similar to what you find in the mine, that is, you should have a velocity of air passing at from 30 to 50 feet a second, with a water gauge of not less than 2½ inches; and if necessary, in the course of the experiments, I should also propose that you had rails and ropes and chains to prove whether what I have suggested previously is a fact or whether it is not, that certain electrical conditions are set up which disturb the dust from the tops of the timbers and the sides of the roads.

4653. You said something about the previous experiments having all been conducted in a straight tube?—I think they have all been conducted in a straight tube.

4654. Then what shaped tube do you propose, or what plan of tube?—I think that you should have a tube made in wrought-iron box girder form, about 30 inches square. I think that would be sufficient, but you must have it long enough. Take the Altofts explosion, for instance. There was a space there of about 150 yards, that is, from 70 to 80 yards on either side of the shot, in which practically no damage was done. I take that as being the combusting chamber, in which a second explosion takes place, that is, the shot blows out into this area, is mixed up with the coal dust thereabouts, and as soon as sufficient air is mixed with the unconsumed powder it bursts into a second explosion, and I consider that the second explosion follows the electrical conditions which throw the dust into the air, and that then the flame spreads throughout the mine instantaneously. I do not think that there is any question of seconds in it. I think it is an instantaneous explosion from that point.

4655. Have you any plan or sketch of the proposed tube to carry your idea out?—No, I have not. I only just made a small hand sketch, which I sent in, and which I think represents practically the workings at Altofts or the roads at Altofts, that is, a straight tube with the higher workings on, the air going round the higher side and also round the lower side, and the return air-way with the crossings in. I think if it were made in wrought-iron, if it were necessary you could extend the length or shorten the length, or make any combinations of those tubes that you choose.

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4656. What length do you consider the tube should be?—Certainly not less than 150 yards in a straight line, that is, irrespective of the higher side and the lower side workings. I think also that you should have what you may call an upcast pit and a downcast pit. If these two were represented by a syphon-shaped tube, then I think that you would be able to get a fan and all the mechanical arrangements of that class handy to the place, and also regulate the pressure in such a way that we could get any water gauge that might be desired. If a tube of that class were made, of course there might also be windows or other means of detecting the way the explosion passed, so that you could follow it all the way through. Upon this electrical business, which I think is a point rather fresh in the matter, I went down last night to the Crystal Palace, and I attended Siemens' lecture on some electrical experiments. I think there is a matter there that possibly might be carried out, which to some extent follows some suggestions made by Mr. Garforth. In that case they photograph, or rather project upon a screen, the vibrations of a telephone, and by that means any particular vibration produced by the explosion could be projected on the screen in a similar way; and if, as I suggested, there is the detonating vibration created by a blown-out shot, you could have that vibration distinctly shown on a screen, and if you choose you could have it photographed for reference, and it would prove more distinctly than anything that could be said what really takes place, whether it is a detonating vibration or simply the passage of a flame as a flame, or whether the dust is disturbed by the sound-wave and is then followed by the flame. I think that you would prove the whole thing in that way by the use of the telephone. In the middle of this telephone Siemens had a little mirror; the light shone on the mirror, and then the vibrations were projected from that mirror on to the screen.

4657. (*Lord Rayleigh.*) With regard to the different explosives, do you think that experiments conducted with the various kinds of powder and with other explosives would be of importance?—Yes; I think so, decidedly.

4658. Such experiments could be conducted without any very expensive appliances, could they not?—Yes, I think so.

4659. You attach a good deal of importance, I think, to the manner in which the stemming is conducted?—I do.

4660. Would it be possible, supposing that regulations were made, that they could be effectually enforced in a pit?—Yes, I think so; because you see in a mine that is dry and dusty any blasting that takes place is even now conducted with a good deal of care—with a great deal of care in fact, and I think after the explosions we have had and the experience we have had in mines using candles and where explosions have occurred, that people are inclined to be more careful than they have been.

4661. So that you think there would be really no practical difficulty in enforcing any restrictions which might be imposed?—I think none at all, especially in regard to the hole, because all the tools would be sharpened and made in the colliery shops, and the blacksmith would regulate the size.

4662. And with regard to the depth of the hole and the depth of the stemming?—As to the depth of the hole, I think that in no case should a fireman or deputy fire a shot without he saw the hole before it was charged. Accidents have happened where the deputy fired a shot without knowing what the hole was, whether it was a deep hole, or a shallow hole, or whatever it might be. He ought also to see the hole charged. It does not take a long while to charge a hole.

4663. To pass to another matter; you were speaking just now of experiments in a long gallery of iron of somewhat limited dimensions. It has been represented to us that no experiments would convince practical miners unless they were conducted in a gallery of almost the same size as the actual gallery of a mine?—I should rather prefer that they were conducted in a very large gallery; but the expense of making such a gallery and repairing the damage done would be very great. Of course the pressures would be very great in a gallery anything like 8 feet square; and if you got a gallery of 8 feet square, if it were a straight gallery of 150 yards long, it would cost a lot of money.

4664. Apart from the question of cost, would it not be difficult through such a large gallery to maintain the current of air which you think important?—I do not think it is necessary, and I would not suggest that it is at all necessary to have so large a gallery. I think if you have something about 30 inches square, which a boy could creep up and either sweep it out and see anything in it, or make any alterations which you might think necessary, so long as the size was sufficient to do that, it might be 3 feet square. I think that would be found amply large enough.

4665. Do you think that the results of experiments conducted in such a comparatively narrow gallery would be accepted by the mining world as conclusive on the point?—I think so. We are hardly supposed nowadays to be quite so simple as in times back, neither the workman nor others. We are all supposed to be a little bit better educated than we used to be.

4666. (*Mr. Bainbridge.*) Have you read most of the evidence already given before this Commission?—I have.

4667. What would you wish us to understand then generally has been the chief points that you wish to put forward as new matter in the evidence which you have given this morning?—I think one principal thing is how it is that coal dust is disturbed in a mine in the case of these big disasters. Another is, of course, this question as to how explosives shall be applied.

4668. Especially with regard to the stemming. I think the disturbance of coal dust and the manner in which it is disturbed has already been brought before us pretty fully?—I do not think anybody has suggested that an electrical condition is set up in the mine which disturbs the coal dust, that is what I mean to suggest.

4669. That is what you refer to?—I suggest that.

4670. That has been referred to by one or two witnesses with regard to the Elemore explosion as being a cause?—I think they said in the Elemore case that it was lightning. I do not suggest lightning at all at Elemore.

4671. No, they said as far as they knew, if you remember, that there was an absence of coal dust, and an absence of fire-damp as well, and that they could not make out therefore what caused the explosion, and it was suggested in a somewhat vague way that it was the presence of electrical conditions?—I did not read that.

4672. However, that may be. I think you will agree that the term "electrical condition" is rather a vague term; we should be very glad if you would explain a little more fully what you mean by the electrical condition?—I am not an electrician myself, but I think that there are certain electrical conditions which may be produced in the mine from the rubbing of the chains for instance, and that sort of thing. A chain after being at work a long time in a mine is very considerably magnetic, I take it, and if you have the force from a blown-out shot to beat, and the stemming forced out by friction and shot across these various things, that is rails, ropes and chains, and signal wires, then you have electricity set up. I do not know how it exactly happens, how it takes place, but a sort of electrical wind takes place, and throws the dust off the various points all along the road. In that way the whole of the atmosphere of the mine is charged with dust, and then it is ready for what I should call the detonating effect which takes place from the second explosion, that is the explosion which takes place in the chamber, we will say of 150 yards long, a sort of detonating vibration which it spreads right away through the mine.

4673. That, however, is a suggestion, is it not, entirely unproved by any practical experiments, or by any explosions which have taken place?—I think the explosion at Udston in Scotland was a decided case of detonation.

4674. I am referring to the electrical conditions that you spoke of; there is no case that you can mention where that suggestion of yours is at all proved by any aggravated explosion that is due to those conditions. For instance, at Altofts, where they had all these conditions of ropes and chains and rails, there was a very big explosion, but for all that you know the explosion might have been equally great and severe if those things had not existed?—I do not say that myself, for

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I do not know what exactly disturbed the dust, and put sufficient in the air in the small time that the explosion occupied to cause the disaster as it happened.

4675. You mean that you think the blown-out shot which happened there could not have been enough to do that?—I do not think it was enough of itself.

4676. It must have required some other conditions which you think existed in the presence of the chains and other iron work in the roadways?—Yes. I find that in Elemore and other cases they are always present, and that if you take a contrary case such as that in the Sheriff Pit at Silverdale in which you have three shots prepared, two of which were actually fired, and one of them was a blown-out shot; you have there a dusty mine, you have all the other conditions, except that you have not these ropes and chains and signal wires, and so forth, anywhere in the line of fire; there was nothing of the sort in the line of fire in the 8-feet Banbury at Sheriff Pit, and, of course, in that case the disaster was simply local; the flame was, no doubt, aggravated by the coal dust floating in the mine, but it was not a coal dust explosion, the coal dust was evidently stirred up, because the two boys were smothered with coal dust.

4677. Now, with regard to the question of blown-out shots, of course you know what a blown-out shot is due to in the first place, do you not?—To the failure of the stemming.

4678. That being the case, the question of one kind of powder or another will not make much difference, will it?—Yes, it makes a great deal of difference. If you get a powder which is very dense, it is well known, of course, that the powder when it is ignited simply burns continuously all the way through, it does not spread to all the grains at the same time. What I say about powder is this, that if you detonate powder and you have a powder of little density, as little dense as possible, you then, by means of detonation, ignite each grain at the same instant, and you do not get the projection out into the mine in the case of a blown-out shot of any unconsumed grains. In all these cases where you get unconsumed grains thrown out into the mine, then as soon as they find sufficient oxygen to complete the combustion they break out into a fresh flame.

4679. You suggested that this E.S.M. powder would be less likely to produce a blown-out shot than an ordinary black powder?—Certainly.

4680. Given 6 inches of stemming and the same size of hole, and the black powder used in one case and the E.S.M. powder in another, the E.S.M. powder being stronger would be more likely, would it not, to blow out the stemming?—If you get a strong explosive the stronger the explosive and the more downward the effect, the slower it is and the more pressure; that is, it is more of a pushing nature. If you get a powder of a high density you simply push the ramming out, and as the burning is going on the whole of the time then you get a very big flame. But you do not get a very big flame, at least I have never seen a flame at all with the E.S.M., and there is very little smoke with it.

4681. Have you tried the E.S.M. powder with a very small quantity of stemming, or rather have you tried it with a view to induce a blown-out shot?—No; I have never made any arrangements to get a blown-out shot.

4682. That is the true test, of course?—I have never made such a test as that.

4683. The real test of the E.S.M. powder is not what it does when tried under natural conditions and with a proper quantity of stemming, but what it does under unnatural conditions, and with a too small quantity of stemming?—When I have suggested all these sort of things to people they say, well, you must not suggest anything of that sort, you must suggest that the powder is used properly, and you have no right to suggest that the powder should be fired without any stemming at all.

4684. Do you suggest that this powder is sufficiently safe to use when you want to depend upon the absence of flame; I mean would you use it yourself in a fiery mine?—In the present state of our knowledge on the subject I do not think I should use the E.S.M. powder except it were further protected. I am told by Curtis and Harvey that if it had not been for the influenza laying up their officials, we should be in a position at the present time to know what their experiments had resulted in. They are experimenting with a view, too, of improving this E.S.M. powder and making it sufficiently safe, or as safe as any other explosive, and I believe myself that they will succeed.

4685. Is it not a fact that what you term a further protective is a source of great danger if placed in the hands of a man on whom the stemming depends?—The difference is here, that in this case the protection will be a part of the explosive, that is, it cannot be separated, it cannot be left out, it cannot be taken away from the explosive in any shape or form whatever. If you get the explosive you have got your protection, and when you put the explosive into the hole you know you have got both your force and your protection at the same time. Any explosive which is protected by water or by any special covering is liable to create a disaster, because as it happened at Sladderhill, the man left out the water; he simply was too idle to get the water, and he put it in without the water, and caused a disaster. I do not hold to one explosive more than to another, but I hold that every explosive ought to be made as safe as it can be with the present knowledge that we have of explosives; but I hold that the protecting part should be so combined with the explosive that when you put the explosive in you have got your protection in at the same time. It is possible.

4686. Do you know of any explosive just now which is so safe as to be safe with an inferior quantity of stemming, and supposing the stemming ought to be 8 inches and you put in 2 inches is there any explosive that you know of in existence that would be safe under those conditions?—There is an explosive I have read about—I do not know anything more about it than what I have read—and that is bellite. No other explosive occurs to me at the present time with which there has not been some accident. There are two explosives which are largely used now, and they are said to be absolutely safe, those are securite and roburite, but there have been accidents with both of them, and therefore we are certain that when there have been accidents with these things that they are not absolutely safe; they are absolutely safe, I suppose, if you fulfil all the conditions.

4687. Can you refer us to any coal mine at present which is using the E.S.M. powder now?—It is being used by myself; but I cannot say for anybody else; I have not asked, in fact.

4688. With regard to your statement as to the temperature of 3,600 degrees, being that at which the flame will not impart an explosion, what evidence have you got of that?—The French Commission stated 2,732° F.

4689. You did not mention the authority?—I take that from their evidence; they say that if you can reduce the temperature down to that point you will not ignite your mine.

4690. In regard to the firing of shots, you have made a special point of the question of leverage, do you not think that the question of doing the work by the explosive depends very much upon the particular point where the shot goes back against the slines or partings of the coal, is that not almost as important as the leverage?—In coal getting, I presume you mean?

4691. Yes, in coal getting?—I do not consider that that is a point at all; I consider that leverage is the great test point, because if you get close against a sline, and you get a large diameter of hole, and a short length of powder, if that hole is put in as far as the sline, then the powder expends its force down that sline, and not in the shape of leverage to fetch coal down; it has gone there, it has not gone to the leverage. If the powder is spread along the hole, even if the sline is close against the shot you lose part of your powder or your explosive into that sline. You have just got a long length of leverage, and that length of leverage will very likely fetch down your coal in spite of the sline taking away some of your strength.

4692. I do not doubt at all the importance of leverage; I am rather pointing to this, is not the question of getting the explosive at the right point a very important one in relation to bringing down the work?—I think it is very important indeed.

4693. Almost as important as the leverage?—Do you mean to say that if you get the explosive at the back end of the hole then you clear your coal out for a certainty to the back of your cutting?

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4694. Yes?—I think that I prefer that you get the leverage even if you leave a bit of coal on.

4695. Now, you spoke about rather a novel point, namely, that it was important in dealing with the different explosives to reduce the size of the hole for the stronger explosives?—Yes.

4696. You do not suggest that there is any novelty in that, do you; you are aware that now, when any higher explosive than gunpowder is used in coal mines, it is an invariable rule to reduce the size of the hole?—I do not think it is the invariable rule; that is just what I think; it ought to be an invariable rule, but I do not think it is.

4697. I suggest to you that it is the invariable rule?—At Sladderhill they used the higher explosive in the same sized hole that they use the powder in.

4698. What high explosive did they use there?—Gelignite, or gelatine dynamite.

4699. In the same sized hole?—Yes, and that was where the two ounces of explosive were bottled up just at the very end of the hole, and I think according to the plans, it was really on the fast.

4700. Surely you know that in general practice the reverse is the case?—I do not know.

4701. Did they use a water cartridge there?—The water cartridge was not used in that case.

4702. Were they in the habit of using it?—Yes, they were.

4703. In the absence of water, are you aware that whenever a higher explosive than gunpowder is used the diameter of the hole is reduced?—I have been decidedly under the impression myself that the same diameter of hole has been continued; if it is altered it is altered recently. I do not know myself that it has been altered. I hope it has.

4704. You may take it from me that quite the reverse is the usual practice. In reference to the safety lamp experiments which you mentioned, where the $4\frac{1}{2}$ per cent. of gas was used, did you try an experiment in that case without any coal dust?—Yes

4705. And with the $4\frac{1}{2}$ per cent. of gas?—Yes.

4706. And no explosion took place?—We got nothing at all; the lamp was not affected, and burnt as happy as possible.

4707. Having found that $4\frac{1}{2}$ per cent. with this coal dust produces an explosion of the lamp, have you happened to try any lower per-centage of fire-damp than that, say $2\frac{1}{2}$ per cent.?—No.

4708. You did not try anything further?—No, I did not. My time was exhausted then, and I did not go into North Staffordshire again after that. If any further experiments were made they were made by the Institute Committee, with which I had nothing to do.

4709. In this experiment which took place, of course the gauze of the Davy lamp during the few seconds during which the experiment endured, got gradually redder?—Yes, it got red hot. It did not get what you might expect if you had pure fire-damp. If you had pure fire-damp I think the gauze would have been very much hotter.

4710. You have mentioned the case of an explosion, I think, with the Marsaut lamp at Morfa?—Yes. It was called the Marsaut lamp, but they had taken the inside gauze out, and it was really a Clanny.

4711. It is well to have put that right. You said the Marsaut, which was the same as the Clanny?—Of course a Marsaut is not the same as the Clanny—they called them Marsaut lamps, but they were Marsaut lamps with the inside gauze taken out, and that reduced them to the Clanny.

4712. A sort of emasculated Marsaut. It was the Clanny that was used?—Yes. In that case I would suggest that there was some disturbance in the goaf close against the $6\frac{1}{2}$, and that possibly forced out some gas, or something of that sort, and that it was not a blown-out shot; the indications there point to its coming from the $6\frac{1}{2}$, and not being a blown-out shot.

4713. You suggest 70 yards as being the length of damp ground which would arrest an explosion, but have you any case in point?—I take the Morfa. In Morfa all the men in No. 7 got out, and they were protected by a length not exceeding, I think, 70 yards.

4714. Then dealing with the preventives which you mentioned to the Chairman, you spoke rather strongly against the value of watering the dust. Are you aware that we have had witnesses before us, I daresay you may have noticed their evidence, who have said that where watering in South Wales is properly done, that is, commencing by making the dust damp, and keeping it damp by regular watering, there is no such effect as you mentioned in the water coming away from the dust?—Yes, I am aware of that.

4715. Would it not in that case strike you that the watering is effective?—I do not think it is of any value whatever from that point of view. I have seen Mr. Stokes, the inspector of our district, who went to South Wales to see this watering, and he says that he went down there and found the air so saturated with water that they had to provide the people working on the roads with flannel suits, but that as soon as ever you take your stick and just stir up the mere crust on the top of the rest the dust is there, and as dry as if it was never watered, and it is on the roof and on the timbers and actually on the water pipes that are carrying the water. It is only a mere shell covering it, and if you disturb that covering by anything that you like you have the dust there still; that dust is not saturated in any sense at all; it has merely got a damp covering, a damp top.

4716. I put to you a case quite different from that where witnesses have told us that the original dust is made thoroughly damp, and then kept damp by frequent watering. Do you suggest that no such a case exists?—I do. I think the dust is as dry as tinder underneath; it is simply a skin of damp on the top, the natural heat of the mine would dry it.

4717. In any case, from that point of view, you would advise, though you did not mention it as a preventive, that the alternative process of constantly removing the dust would be a wiser one than watering?—I think so, together with thoroughly wet patches here and there on the road, I think that would be a good deal more effective. Of course, I am not going to run down the watering as done in South Wales, because it is a very sanitary matter; it makes the road a good deal pleasanter to travel on. At the same time I am not at all certain—if you experiment, of course you will be able to ascertain it—that if you have a certain amount of aqueous vapour in the air, and a disaster takes place that it does not help it along. I think you will perhaps be able, when you come to experiment, to prove that the aqueous vapour may help; I almost think it does myself.

4718. The provision you require of wet patches would only be a way of reducing the extent of the explosion?—Certainly.

4719. But preventing the explosion is far better, is it not—to aim at the first cause, and to remedy that?—I propose that, of course, the first cause shall be protected as far as possible by applying the knowledge that we have, or that you will be able to furnish us with, as to the proper use of these explosives. The other matter of using the sprays of water, I take it, is a very important sanitary matter. I do not say anything against it at all, but I simply say that I do not think it is a preventive of an explosion.

4720. You mentioned as another preventive, that no shots should face the current; what was your idea in proposing that?—I take it, at Altofts, and also at Elemore, and I think I may say generally in every big disaster which has occurred from a blown-out shot, the shot has always faced the current.

4721. At Altofts I may correct you, perhaps, it was at right angles to the current?—They do not seem quite certain about that. They say so far as they can tell, it was at right angles. I should say myself that the way they put it in shows rather that it might be to a certain extent at right angles; but I think it inclined a bit towards the pit.

4722. Do you think that a blown-out shot which caused an immense explosion anywhere would have avoided causing an explosion by its direction being changed?—If that shot at Altofts had been the opposite way round, I do not think it would have caused an explosion.

4723. In that particular case?—Yes, I am rather inclined to think it would not have done so.

4724. Mr. Garforth was not of that opinion, was he?—I never asked him. I think it is a matter that you will be able to prove distinctly.

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4725. Then with regard to the use of the electric current instead of a fuse, your suggestion is, I suppose, that there is more safety in the electric firing than in the fuse firing; but do you in that case think that the fuse firing is unsafe?—I do not say that it is altogether unsafe, because you may fire the fuse without igniting the gas; at the same time the electric fire is the safer of the two. I do not say that you cannot fire it with a fuse with safety, but at the same time I say the electrical is the safer plan.

4726. With regard to the question of the examination of the hole before a shot is fired. I daresay you may know that in some well regulated mines it is the practice to have every hole examined before the collier fires a shot?—Certainly it is.

4727. You rather mentioned it as being a desirable precaution to take?—Yes, because I know it is not done everywhere, but at the same time, the regulation might be added, that it must be examined before the shot is fired. I have had a case myself, where there has been a blown-out shot (which did not cause a disaster), where the hole was not examined by the fireman before he fired.

4728. With regard to your suggestion as to the gallery being 2 feet 6 inches square, I suppose you prepared this sketch you have brought before us in order to obtain as nearly as possible the condition of a working mine?—Yes.

4729. Do you not think this would be equally as useful in case we have a gallery going, as you put it here, a certain distance, and having angles in it of the same kind. So long as you have several angles it is not necessary to go all round the square shown in your diagram, is it?—The question at Altofts was that this explosion turned at right angles, and it seemed to prefer going away to the right rather than taking the shaft just close to it; that is the only thing in it. I only drew that sketch as representing roughly the roads of a pit, and it may be either extended or lessened according to circumstances. I do not say that all that is absolutely necessary, except that you should have a tube not less than 150 yards in length, and carried round to form a square so as to obtain compression by the collision of the forces which are trying to escape from the centre of the explosion.

4730. You do not suggest that this idea of making the ends of a syphon form is of any particular service; so long as you get an opening of some kind there is no advantage in having it in a vertical direction?—Except for convenience.

4731. Would it not be very convenient to have an open end horizontally?—Of course, if you put angles in it will almost come to the same thing as my syphon.

4732. Except this, that there would be the advantage of having horizontal ends as they are now arranging it on the Tyne, at Newcastle; the observer can immediately walk in and see what has happened during the explosion; whereas if you have shafts vertically arranged it will be rather difficult of entrance, unless you have doors at the bottom?—In that case, even if you carried out that, I should suggest that you have places where, by taking out certain bolts, you can get access to any part in the same way.

4733. In your replies to the Chairman you did not make any reference to the comparison between lamps, which is made in the paper, a copy of which has been sent to us. Do you wish to make any remark upon that?—As to the detection of fire-damp, do you mean?

4734. I think what you have done here is rather to describe the Peiler lamp, and another lamp which you thought was equal, if not superior, to the Peiler?—Of course, if you are going to fire any explosive in a dusty mine it is of the greatest importance that you detect very small per-centages of gas. The Peiler lamp, not being a safe lamp, that is from its cubic capacity, it will fail in an explosive atmosphere, even if there were no velocity, I set to work to try and make a lamp of ordinary construction, which would give equally satisfactory results. By using, if you like to use alcohol spirit without a light, you can get a perfectly safe lamp, and you get a shorter cap with the same certainty that you do in the Peiler. The caps in all the covered lamps are shorter than they are in the exposed lamps of the Peiler because, of course, the atmosphere of the mine comes in contact with the flame of the latter lamp at every point, of course it is fed from every side, the consequence being that you get a very long cap from a very small per-centage of gas. If you have a spirit flame placed inside a safety lamp of any construction you like, Gray's, or whatever it may be, you get a shorter cap even with the same flame, so that you can make these detections if you like to use the lamp; the only thing is that I suggested benzoline or colzaline, as the protector people call it, as being a means of carrying a flame which will illuminate your way, as well as being a good hot non-luminous flame for making tests for gas. We found with the benzoline flame reduced and perfectly non-luminous that you have got a test with which you can read down to ½ per cent.

4735. Then you referred to the colzaline lamp from that point of view; having, as it has, about the same illuminating power as an ordinary colza lamp, you regard it as being more useful for testing gas than the ordinary protector lamp, would you say, to commence with?—No, not the ordinary protector lamp; as far as the illuminating power is concerned I do consider it good; but, in the ordinary protector lamp, the lamp bottom is held by a shutter which simply slides over. If your lamp bottom is hot, as it generally is in a dusty mine, then there is vapour given off the whole length of the time that you are using the lamp; and that vapour escapes through the shutter hole, and then, as I know from my own experience, it works up through the coarse screw and fouls your test, as people often say you find gas where there is no gas—you may find gas in the cabin at the pit bottom. Now, if instead of making the shutter hole simply solid, if you screw that down and make it perfectly air-tight——

4736. As you have in your improved lamp?—Yes; and then carry a small tube up the centre of your wick which is perfectly free, to the inside of the lamp and to the outside of the lamp, then any gas created inside the vessel comes up this tube, and is burned in the flame and does not vitiate your test; it forms part of the flame then, and then you have nothing except the air of the mine to give you the test for gas.

4737. Is this new lamp in practical use anywhere now?—There are a good many out now; mostly they are in use at some of the naphtha works. Curiously enough there are two in use, I think here in London, and one at Turney's Works at Nottingham. Those works are something in the leather business, they use some volatile and explosive liquid.

4738. I mean are they now in use in any coal mine for the purpose of testing any quantity of gas?—There are some few.

4739. Whereabouts?—Generally speaking people say they find plenty of gas with what they have got. I think I had a dozen of those lamps made and there are 11 of them in use. Do you mean to say, is there any demand for them?

4740. No; I do not ask that. I mean, is any mine now using them for the purpose of testing gas in smaller proportions than they were able to find with the Davy lamp?—There is one at Ashton Moss, and Mr. Grundy, one of the inspectors for Lancashire, is using one.

4741. With regard to the Peiler lamp, you mentioned that it was an unsafe lamp; with what velocity of fiery current do you say it explodes?—I think it will explode with no velocity at all—in a still atmosphere.

4742. Has that experiment been tried?—Judging from Marsaut's tests that lamp will explode readily. I have always been instructed myself that if you go with a Peiler you have first of all to test with an ordinary lamp to see whether the atmosphere is explosive. If it is not explosive then you are to use your Peiler, but you are not to use your Peiler first.

4743. Then you suggest that if a man goes into a place to test with a Peiler for ½ or ¼ per cent. and he finds the atmospheric condition is explosive there will be an explosion?—I think the chances are that there would, I should not like to do it myself.

4744. (*Mr. Fenwick.*) I think you said that you had been using the E.S.M. powder yourself?—Yes.

4745. Have you had much experience of its use?—I have always used it in every condition in which I thought there was any risk whatever. If there was any place where there is any gas about I always use it.

4746. You never had any knowledge of a blown-out shot?—None at all, not a single case.

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4747. Do you suggest that that fact is due to the quality of the powder used rather than the carefulness with which the shots were prepared?—Principally to the powder itself; to the sudden and the complete combustion taking place before anything gives way the combustion is complete; it is always detonated, always used with a detonator.

4748. Did you take the precaution to examine in every case the hole before the shot was inserted?—Not myself; of course the officials have.

4749. You seem to attach a great deal of importance in your evidence to the stemming of shots. You are aware, no doubt, that the Act of 1887 prohibited the use of small coal for stemming?—Yes.

4750. Do you think that that provision is very generally enforced?—I think it is generally; at the same time people sometimes take the handiest thing. In the case at Ashton Moss (that was only last year), they simply took the dust off the floor, coal dust and all the stuff mixed together, simply wetted it, and put it in the hole, and that was used as stemming. In that case there were two men killed. That shot did not blow over the rails at all, it blew straight down an air-way where there were no rails, no plates, or anything at all.

4751. You seem also in your evidence to suggest that it would be desirable to leave a little of the coal that was holed on, rather than to run any risk by shutting it all off?—Yes, I should prefer that point too, but, as Mr. Bainbridge has said, if a man cuts to a sline or a face at the back he would not naturally put his shot to touch that sline, he would leave some little piece on, perhaps an inch or two, and then it would be sure to fetch it up to there.

4752. Are you not aware that in most instances when a workman cuts to a sline or a parting in the coal he is unaware of the fact that he has done so?—Of course I have got Derbyshire in my mind at the present time, and the slines there. They generally do cut to a sline there.

4753. Has the workman any knowledge that he has done so?—Yes.

4754. Are the slines there open? — He decidedly knows that they are there in that particular case.

4755. (*Mr. Bainbridge.*) How does he know?—They find them distinctly in the case that was in my mind just then; the slines are well defined.

4756. Do they find them with the drill?—Not with the drill but by cutting, because the cutting would be made first, of course, and then the drilling would be done afterwards. I do not think that the diameter of the hole will lessen the chance of kicking off to the back, not the least in the world, because the pressure would be there the same.

4757. (*Mr. Fenwick.*) Have you any suggestion to make as to the best material to be used for the purpose of stemming?—I think the ordinary floor dirt, I mean to say the marly floor dirt; you cannot mend that a great deal when it is damp.

4758. Would you suggest that in any amendment of the Mines Act the examination of the hole and the preparation of the shot by the fireman prior to the charge being inserted should be made compulsory?—Yes, I think that it ought to be a compulsory matter that the fireman before he fires the shot should see the hole and should have the opportunity not only of testing the hole, but that he should see it charged; it is not a long matter to charge the hole, he would not have long to wait.

4759. Then with regard to your statement that no shot should be fired facing the current, do you suggest that that should apply to all shots or only to shots that are fired in the main roads?—I think that that is only of great value where you have a very strong current, and that in an ordinary coal face you have not; you very seldom have there any current of from 30 feet to 50 feet a second. I only mean that to apply where you have a very strong current, and that is principally in the main roadway. As to the coal face where there is an ordinary current passing, I do not think it would matter at all, because there is no large quantity of fine coal dust anywhere about. I am told that the French Commission proved that it was dangerous to fire a shot directly facing waste or gobbing, that is, if you have a waste with a broken down place in it, it is dangerous for the shot to face that on account of the compression, but I do not know for a certainty about that.

4760. Are you aware that it has been stated in evidence here that a blown-out shot in the coal face was the cause of the recent explosion at the Apedale Colliery?—Do you mean Sladderhill?

4761. Yes, it is called both Apedale and Sladderhill?—Yes. That was in the heading; it was in the coal face.

4762. It was fired against the current?—No; excuse me, there was no current at all. If you refer to the plan of the shot itself you will see that it does not face the current; it does not face it in any way; the air-pipe did not come as far as the end of the heading.

4763. Do you suggest that there was no air coming in here (*pointing to the plan*)?—There was only a blow just there; there is no velocity anywhere there.

4764. But still, to some extent, it must have been against the current?—No, I do not hold that it is against the current there.

4765. Would you think that it is practicable for shots that are fired in the working face to be fired otherwise than against the current?—I do not make any rule about facing the current as far as concerns shots fired in the working place, for the simple reason that I do not consider there is any great danger in facing the current as far as I know, unless the current has a velocity of about 30 feet per second.

4766. Then your suggestion would particularly apply, as I understand, to shots that are fired in the main roads?—Certainly (*pointing to plan of the Apedale explosion*). There are rails in this case; but in many of the explosions there are no rails. That shot blew straight away here on to those rails and into that coal dust. I suggest, according to this electrical theory, that it disturbed the dust lying here and carried the flame; I do not think the flame from *there* caused the entire loss of all those men. I believe that electrical condition is always suspended once it comes to a wet place, then whatever electricity is present makes earth at that wet.

4767. On the question of lamps, you seem to attach very much importance to the character of the safety lamp which is in use in fiery mines Are you acquainted, I suppose you are, with the report of the Royal Commission on accidents in mines?—Yes.

4768. Especially with regard to the experiments that they made as to the comparative safety of the lamps in use?—Yes, I am acquainted with that report; but, you see, in that report there were no experiments at all made with coal dust and safety lamps.

4769. Are you aware of the experiments that were tried, particularly with the Davy and the Stephenson lamps?—Yes.

4770. I have no doubt you are aware of the fact that, under certain conditions, the Davy lamp, when it was encased in a tin can, was the safest of all lamps employed?—It is a safe lamp in a case under those conditions.

4771. But without that protection it was the most dangerous of all?—I do not know that it is any more dangerous than the Clanny.

4772. Are you aware that that is the report of the Commission?—Judging from my own experiments, a Clanny lamp fails nearly as soon as a Davy lamp, that is, if it is unprotected.

4773. Would you agree with the finding of the Commission on that point?—Without coal dust, yes. I should take that, because when you are experimenting you cannot get the exact conditions always the same.

4774. Would you suggest that when the Davy lamp was used in an explosive mixture it should have the protection suggested in the report of the Royal Commission?—I should not use the Davy lamp, and I should not like to know that the Davy lamp was used otherwise than protected. A Davy lamp protected as we often find it nowadays, in the presence of an explosive mixture such as I have stated without coal dust, is safe, but I do not know whether it is safe with coal dust.

4775. (*Professor Dixon.*) Did you visit the Sladderhill Pit after the explosion?—No, I have not visited Sladderhill.

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4776. Then you do not know it personally?—I do not. I only know it from reports.

4777. Do you know where the rails are laid in the levels there?—Yes, they come right opposite the heading where the shot was.

4778. Are they laid in both levels, in the lower one and in the upper one?—Yes, in both levels.

4779. And do the rails reach to the last thirling?—Judging from the drawings they did.

4780. The pipe did not reach as far?—Not quite.

4781. I might correct you there; there were no rails?—I thought the rails were represented on the plan.

4782. No, I examined the pit myself, and there were no rails, and the pipe did not come opposite the thirling, it stopped some feet before it got there, so flame could not have blown over the rails or pipe?—Only where it burnt that heap of dust; there must have been a very large flame, and that pipe is very close to it.

4783. It was not in a direct line?—No.

4784. I wanted to call your attention to that. Would you explain what you mean by the leverage of a charge?—(*Illustrating.*) Supposing this is a piece of coal which has to be blown off, the hole is placed in we will say so, and the leverage that I speak of is represented by the length that the charge lies along the hole.

4785. Why do you call that leverage?—You see it is holed in under here, it is vacant here, and the leverage is from here to there.

4786. The length of the charge you call leverage?—The length of the charge is leverage.

4787. You spoke of a second explosion occurring. I think, if I remember your words aright, you said unconsumed powder is blown out from the shot hole and may be fired when excess of air reaches it, or some words to that effect?—Yes, when there is additional air mixed with it. I will give you an instance that I have seen myself which would very likely be a good sample of what can happen in this case. It was at an ironworks. In cleaning the tubes from the furnaces to the boilers at certain stated intervals they brush out a large amount of soot and unconsumed carbon of some sort. This is cooled with water on the inside and then scraped out through manholes at the bottom. In the case that I saw myself, as soon as the stuff had dropped down I should think about 4 yards below the piping in a black mass it suddenly burst into flame. If you take a blown-out shot in like manner to that you have unconsumed grains of powder. I am supposing the stemming as being either dust or containing carbonaceous matter, it is all at a high heat, and mixed up with the unconsumed grains of powder, and as soon as ever that gets mixed up with sufficient air it bursts into a second explosion.

4788. I understand then, you suggest that the unconsumed grains of powder require oxygen in the air to burn them?—Certainly I suggest that, and I think it is certainly proved that those grains of powder are surrounded by, we will say, the products of the combustion of the other grains of powder which prevent the burning of that powder; and I have myself two grains of powder blown out of one of the 81-ton guns, which are only partly consumed; they are left about the size of my thumb nail. I suppose that the sulphur is entirely burnt out of them, and there is only the rest of the ingredients left. Those I have, and I know, of course, that these grains are blown out of guns in that way.

4789. What is the composition of the Curtis and Harvey powder which you describe as E.S.M., do you know that?—I do not know exactly what it is, I should think it is about 75 per cent. nitre, but I could get it for you.

4790. It is a powder composed of charcoal, sulphur, and nitre?—Yes, it is an ordinary powder, I suppose it is kept in the incorporating mill for a greater length of time, rubbed together very carefully, and then the powder cake is not pressed to such a large extent as ordinary powder.

4791. Is it a quick-burning powder?—Yes.

4792. Then you said that you had calculated the constitution of the atmosphere of a mine previous to an explosion, or that Dr. Carnelley had done so for you?—Yes.

4793. How does that effect the question, whether dust will be fired by a blown-out shot?—It was made in that case to prove that an atmosphere which is not explosive in the ordinary way, becomes by the addition of these other ingredients an explosive atmosphere, at any rate you will get an atmosphere left which will burn after the shot is fired. If you look at the table which I have put in, perhaps you will understand my explanation.

4794. How does the constitution of the atmosphere affect the question whether dust will be fired if a shot blows out?—You get the blown-out shot and then you get the addition of the dust for the second explosion; you have got additional carbon and you have got additional oxygen.

4795. Do you mean by the second explosion a second after the shot itself?—Yes, after the shot itself. First of all your shot blows out, and that shot which blows out consists as we may say of unconsumed grains of powder; supposing there is coal dust in the stemming, there is that coal dust, and then you get additional coal dust in the atmosphere along with the additional oxygen, and that bursts into either a second explosion or a second violent inflammation, whichever it may be.

4796. I thought you said that after the coal dust in the air had been ignited the air came back again and you had a second burning of carbonic oxide, I think you said, and that that was the second explosion?—That is the third effect.

4797. So that you have three explosions following a blown-out shot?—Yes. It was known, in olden times at any rate, I have read it, I do not know it for myself, and I have never seen it done, but I have been told that years ago the colliers working in a heading where they were short of ventilation purposely under-powdered their shot, and then when the gases from the shot were oozing out of the different breaks in the coal they took a candle and fired the gases. I know a man who told me years ago that he had done it. I believe he is alive still, but I have never seen it done myself.

4798. Did you use the phrase under-powdered the shot?—Yes.

4799. Do you mean putting a little powder in?—Yes, that is so. I was told that it broke the coal but did not fetch it down. They took the candles and lit those gases and of course that converted the gases into carbonic acid.

4800. (*Mr. Bainbridge.*) Do you say that in this last case they lit the gas all round because ventilation was bad?—Formerly.

4801. Would that not make the ventilation worse by producing more carbonic acid?—Yes, but then the carbonic acid gas would occupy less space, and, of course, it would not be as poisonous as the carbonic oxide.

4802. Quite sufficiently poisonous, would it not?—I suppose a man would get along better; that was the principle upon which I suppose they worked. As I say, I have never seen it done myself.

4803. Do you suggest that in every case of a blown-out shot the grains of powder which come out are to some extent unconsumed?—Yes.

4804. Do you not agree that in the case of a blown-out shot it is simply a question, not of the powder failing to do its work, but finding the work through the hole easier than breaking down the coal; is that not so?—It escapes through the hole instead of breaking down the coal.

4805. So that there is no reason why the powder, in forcing all its strength in pushing the stemming out of the hole, should be unconsumed?—It does not exert all its strength.

4806. It is blown out simply because the stemming is easier to blow out than it finds the coal is to break down?—Yes.

4807. Therefore, as the stemming is easier to blow out, there might be quite enough strength to resist it in the stemming to cause the powder to be consumed?—I do not say that every blown-out shot would cause a disaster, because I know of a case myself where a blown-out shot did not cause a disaster. That was in the Arley mine.

4808. Will it not be the exception for a blown-out shot to have unconsumed powder rather than the rule?—I should think it is not what you may call a common case. A shot would have to be largely overpowdered to produce a case of that sort. For instance, in the Altofts case they say there might have been from 2 lbs. to

3 lbs. of powder. Two lbs. or 3 lbs. of powder, you know, would be tremendously overcharged.

4809. (*Lord Rayleigh.*) A large quantity of unconsumed powder is blown out of all modern guns?—Yes; I have two grains of it. Excuse me, about that question of the oxygen. I am instructed that a grain of powder under such conditions is surrounded by gas which prevents that combustion going on; but at the same time the whole thing is so hot that as soon as ever you get additional oxygen you get the continued inflammation.

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(*Professor Dixon.*) I think you have been wrongly instructed.

The witness withdrew.

Adjourned.

At 23, Great George Street, Westminster.

THIRTEENTH DAY.

Friday, February 26, 1892.

PRESENT:

THE RIGHT HON. JOSEPH CHAMBERLAIN, M.P., CHAIRMAN.

Sir WILLIAM LEWIS, | Mr. EMERSON BAINBRIDGE.

Mr. J. WILSON, *Secretary.*

Mr. DAVID MORGAN called and examined.

Mr. D. Morgan. 26 Feb. 1892.

4810. (*Chairman.*) You are the agent, I think, for the Aberdare and Merthyr Miners' Association?—Yes.

4811. How many men are represented in your association?—Something like 8,500.

4812. Have you yourself worked in mines?—Yes, for 35 years.

4813. In what part of the country? — In South Wales.

4814. Are the mines of South Wales fiery mines?—Yes.

4815. Are they dusty mines?—Yes, the majority of them.

4816. Now, what effect, in your opinion, has the presence of dust in causing explosions or in increasing their effects?—I do not believe that coal dust does cause explosions, but I believe that when explosions do take place the dust plays havoc with the men after the explosion. In the first place an explosion goes along like a hurricane, and it raises the dust, and the flames roll through the dust and kindle it. A brother of mine had some experience in that direction. We were both in the pit at the time of an explosion, but I was not actually in that explosion, my brother was, and he stated that in his opinion most of the people were killed by breathing the dust which was burning in the interior after the explosion.

4817. Now, with regard to the commencement of an explosion do you think that a blown-out shot will ignite the coal dust?—That depends upon the nature of the blown-out shot. A blown-out shot does not at all times create a flame, but there is a possibility, as I have seen it before now, of a blown-out shot creating a flame, and that flame reaching the gas, and the gas igniting, and hence the explosion. I do not believe that a blown-out shot of itself will ignite the dust, and through the dust make a terrific explosion.

4818. Have you seen any account of the experiments which have been carried on with coal dust?—No, I have not witnessed the experiments myself but I have read a little of them, and I have heard gentlemen whom I could believe say it is the case that coal dust does cause these explosions, but I have not seen it. I will admit this, that there are different kinds of coal, and, therefore, different kinds of coal dust; and I have no doubt but what some kind of coal is more explosive than others, but I have not witnessed it; and I do not believe that the coal dust in Wales is so sharp that it would ignite at once, by the light of a candle as it were.

4819. Supposing that an explosion of gas takes place, do you think that that could be carried on to greater distances than it would otherwise go by the presence of coal dust?—Most decidedly.

4820. Therefore, in your opinion, the presence of coal dust in a mine is an increased source of danger?—There is no doubt of it in my mind.

4821. And do you think that where coal dust is present the explosion is likely to be more fatal than it otherwise would be?—Yes; especially when the place is extremely hot; and then the smaller the dust the more effective it is.

4822. That being the case, what precautions do you think ought to be taken in order to prevent this danger?—The best precaution that I could suggest is that the coal dust should be removed as far as practicable, and be watered in order to put it down.

4823. Is watering generally practised in the South Wales mines?—Yes.

4824. Does it have the effect of keeping the coal dust damp?—Yes.

4825. We have been told that the water remains on the surface and that the coal dust underneath the damp layer on the top is perfectly dry, and might just as well produce an explosion as if there had been no watering at all?—I have seen that allegation by Mr. Galloway, if I remember rightly, who has written a very good book on the question, but he goes to extremes, in my opinion. I believe the colliery managers and the colliery owners all round are much more careful of the dust and clear it off much better, and so they do not keep such a stock of it now on the roads as they would, and they are watering to my knowledge with pipes on the main roads, and so keep the dust pretty well damped down. I believe that the collieries are better ventilated and kept in better health than they were some 20 or 30 years ago.

4826. Have you given any attention to the question of explosives?—Yes; explosives are very good agents in coal getting, and it is very desirable, in my opinion, to get explosives which are not inflammable.

4827. So as not to produce a flame, you mean?—Yes.

4828. Are you aware of any explosives which can be relied upon not to produce a flame?—No, but I have seen a test made of the bellite powder, and I did not see any flame created by that. They tell me that in certain experiments made afterwards, someone, I presume owing to a very great extent to competition between the different patentees, did succeed in getting flames from everyone of these explosives, but I was not present at the experiments myself. I was, as I say,

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present at an experiment tried with bellite powder, and then I did not see any flame at all.

4829. Is powder much used in the South Wales mines?—Yes.

4830. Do you think that it ought to be prohibited?—No; I hope not at any rate, because it would be a most detrimental blow to the South Wales mines, and colliery owners as well, to do away with it.

4831. Are not what are called flameless explosives as good as the powder?—No. The bellite powder has been tried, and another powder composed of lime and some chemicals, but they were not so effective as gunpowder.

4832. Is not gunpowder more dangerous in regard both to gas and to coal dust?—Yes, there is no doubt about that.

4833. But you still think that the risk ought to be taken?—We are justified, in my opinion, in running some risk at all times rather than to do away with the working of the coal mines. Of course we ought to do everything we can to avoid explosions, but whatever we may do and whatever we may say we will never get rid of them altogether; we must have some risk, and I have no hesitation in stating that if you would do away in Wales with powder as an agent that would be the means of stopping something like one-fourth of the collieries, because it would create an increase of labour which would increase the cost of production, and so stop the collieries.

4834. Can you say why the blasting by flameless explosives should be more difficult and more expensive than blasting by common powder?—Somehow they do not produce the same results, not nearly the same. Where we have rock it is very difficult to get these powders, such as bellite and the lime mixture I spoke about, to bring the rock down in much of the hard ground which we have in Wales, in some cases at any rate.

4835. Have not the explosives that you are talking of, such as bellite, as great an explosive force as powder?—No, nothing like it.

4836. Do you use water cartridges in Wales?—Yes.

4837. Do you like them?—I have not had experience of the water cartridges myself, and therefore I cannot say, but I know that they are used in Wales. They are not used to a great extent, they are only used where they are essential, because of the water.

4838. Is there anything else you wish to state to the Commission in regard to the question we are investigating?—No, I do not remember anything else.

4839. (*Sir William Lewis.*) You referred to the means of watering; have you seen the most recent means adopted, where the water is provided in sprays and carried in with the intake air?—Yes.

4840. Do you consider that is a very great advantage in the carrying on of our dusty mines?—Yes, it is excellent. It is improving the health of the horses and of the men, and in my opinion enables the colliery owners to work more coal out upon the same ventilation.

4841. Would you, from your experience, say that where that is done effectually the use of gunpowder could be continued with little or no risk in carrying on our collieries?—Yes.

4842. Without resorting to anything in the shape of cleaning, or of an examination of the place beyond what is now provided in the Act of Parliament?—I believe that it is necessary to clean the dust, because, as the Chairman has just intimated, if you leave a thickness of dust, say to the amount of 6 inches, then if you water that the dampness will be on the surface, but in many places where I have been the watering is done so effectually as to go through, say, 2 inches of the dust.

4843. So that where the dust is not removed from time to time or kept, at all events, down to a very thin covering, it would be dangerous to continue the use of powder, would it not?—Not where you are watering; that is where the watering is thick.

4844. But where the watering only penetrates, as was suggested by the Chairman, just through the covering of the thick layer of dust?—Shot-firing by means of an inflammable explosive should not take place in such places, in my opinion.

4845. But you have had no personal experience with any of the flameless explosives?—No; only I saw the experiment which I told you of at Werfa.

4846. Are you quite clear as to bellite and those other explosives not being sufficiently strong to break down the hard ground in our district?—I have not had much experience; I only saw that one experiment, and therefore I cannot go so far as to say that they are not altogether effective; but the experience of the men points in that direction. They have tried the roburite powder at the Plymouth collieries; but the men went against it altogether because they could not think of using it—it was ineffectual.

4847. Was that for want of power or because it gave off any objectionable fumes after the shot?—Both.

4848. Which was the greatest objection. Supposing it did not give off those objectionable fumes, would it be an advantage to use that rather than powder?—No; I believe, according to the evidence that I have from the men, it was so ineffectual that they could not go on, and it was much more expensive.

4849. Then you said that blown-out shots did not always give off a flame?—Yes.

4850. Are you speaking now from personal observation?—Yes.

4851. In the greater number of cases blown-out shots do give off a flame, do they not?—No.

4852. Have you ever seen them give off any flame?—Yes.

4853. So that where you have a blown-out shot, and where there may be dust and a possibility of any gas in places where you could not detect it, that would be attended with considerable danger, would it not?—Yes; but in my opinion before the coal dust will ignite—in Wales at any rate—the place must be rather hot; and in such places I would prevent shot-firing altogether, except you got a powder which would not give off a flame.

4854. At all events, if you could get the same power you would think it a very great advantage to have a flameless powder?—Certainly so.

4855. Then you also said, in reply to the Chairman, that you did not think a blown-out shot could create an explosion; what had you in your mind when you said that. Assuming there was gas existing within the range of the blown-out shot, do you suggest that that would not create an explosion?—I mean this; if a blown-out shot had no flame it would not create an explosion, and if it had a flame, if there was no gas to feed it afterwards, there would be no explosion—of any magnitude at any rate.

4856. No; but you have had sufficient experience in places where you have been working to assume that gas may be lurking in a place which you could not possibly ascertain, even by examination, previous to setting off a shot?—Yes. In that case of course when a blown-out shot gives off a flame, and that flame reaches those cavities, it might create an explosion—and it would.

4857. Have you anything to suggest to the Commission by which the risk attending the carrying on of operations under those circumstances could be reduced?—The only way is, in my opinion, to water the places as much as practicable, and another thing, to get flameless explosives.

4858. That would be dispensing with the use of powder, because powder is not flameless?—Exactly, if flameless and effective powder can be got.

4859. You admit that?—Yes.

4860. Would you say that every care is taken in examining the places in the immediate neighbourhood where shots are proposed to be fired?—I would not go so far as to say that every care is taken, but I believe that the practice in this case is very good.

4861. You have nothing to suggest by way of additional precaution in that way, have you?—No. We have careless men, of course. I believe they are well instructed. The law, in the first place, in itself is a precaution, and if the law is carried out it meets the case, but we must admit that there are some men in the collieries, the same as in every other business, who are not altogether at all times up to their business, but the practice is very good on the whole.

4862. Now in many cases, as you know, in our district powder is used not only for hard ground in

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ripping the top or in lifting the bottom, but also in coal?—Yes.

4863. Would you say that there would be an advantage in dispensing with the use of powder in coal getting, and in limiting its use to the hard ground?—As I have said before, it means stopping something like one-fourth of the collieries in Wales.

4864. Do you think so?—Yes.

4865. What additional cost would you, as a practical man, say would be imposed upon the owner if with respect to coal itself there was no powder used?—I have no hesitation in stating that it would create upon one-fourth of the produce something like 6*d.* a ton.

4866. Is it not the fact that powder is very largely used in coal getting where it is not necessary?—I would not put it largely used in that direction, but I believe that there is more powder used than should be used.

4867. And that it would be a very great advantage if it was limited in its use in the actual coal getting?—I believe that much of the powder which is unnecessarily used is used by unskilled labour. It is much easier for a man to be taught to use the drill and to put in a shot, than it is for him to be taught to trim the coal the same as it was 20 and 30 and 40 years ago.

4868. And would there not be another very great advantage in limiting the use of powder, that coal would not be so broken up as it is where powder is so extensively used?—There is no doubt about it.

4869. (*Mr. Bainbridge.*) Before you and Mr. Isaac came here to give evidence, did you have a meeting with the council of your miners' association?—No.

4870. Then, are you giving your own evidence without any conference with your fellows?—Yes.

4871. It is entirely on your own account?—On my own account.

4872. In answering Sir William Lewis' last question with regard to there possibly being too much powder used in your district, you were referring, I suppose, to South Wales only?—Yes.

4873. And you have no knowledge of whether that answer would apply to any other part of England or Wales?—No.

4874. Now, with regard to shot-firing. Would you kindly explain the manner in which the shot is fired in your district? Who drills the hole?—The coal cutter.

4875. And who fires the shot?—Where the safety lamps are used, a special man goes to do it, but where they are using the naked lights, the men do it themselves.

4876. Where safety lamps are used, a special man goes round and fires the shots?—Exactly.

4877. That special man does not examine the hole which is being bored, nor the quantity of powder put into the hole, does he?—No.

4878. Does he make any inquiry as to the quantity of powder put into the hole?—No.

4879. Then that is left entirely to the judgment of the collier?—Yes.

4880. With regard to the question of the safety of a shot generally, I suppose you would say that in order to prevent blown-out shots, and their consequences, you would first of all examine the district to see there is no gas and no danger from gas?—Yes.

4881. Would you not also consider it rather an important matter to see to the condition of the hole, and to see that the right quantity of powder is safely put in and the ramming properly done?—Yes.

4882. Would not that reduce the number of accidents if that were more properly watched?—Yes; but if the colliery owners were to get men to do that, they would have to put on four men to look after that business instead of the one that they have at present.

4883. You think the number of men required to do that would be so great?—Yes.

4884. And that that would be a serious cost?—Yes. In my opinion it would have been a better remedy to teach the men to understand their own business than to get other men to look after them; to teach every collier, before he had a place to himself, what is the proper way to cut coal. I believe there are great defects in that direction in collieries at present, so far as Wales is concerned at any rate. I have no doubt they are as well up to the mark in Wales in that respect as at other places, but then I have no practical knowledge of other places.

4885. You think that besides the natural experience which every collier gains year after year in constantly firing shots he ought to have some specific training?—Yes.

4886. That would be useful to him?—Yes.

4887. So as to be able to judge both as to the quantity of powder, and the quantity of ramming, and the depth of the hole, and so on?—Exactly.

4488. But I suppose by degrees your men get extremely skilled in that way?—Yes.

4889. So much so, that it is a very rare thing to find a blown-out shot?—Yes, they are getting better all the time according to their experience.

4890. Now with regard to these blown-out shots, have you had much experience of them?—I do not remember many that took place with myself, to tell you the truth.

4891. How many have you seen in all your career?—I could not say.

4892. Fifty?—Much more.

4893. Blown-out shots?—Yes, hundreds of them.

4894. Hundreds of blown-out shots?—Yes.

4895. Would you not say that it was more the exception than the rule to find them free from flame? Is there not more often the presence of flame with a blown-out shot than an absence of flame?—No, it is an exception to get a flame.

4896. That is your experience?—Yes.

4897. With regard to the question of watering, you would say, I suppose, that there were two modes of dealing with coal dust, one the watering, and the other the removal of the dust?—Yes, but you could hardly ever remove the dust in collieries so clean that it would not be necessary to water.

4898. Then to which process do you attach the greatest importance?—To both of them.

4899. Which chiefly?—The watering, I should think.

4900. I suppose that it is partly because it is almost next to impossible to remove all the coal dust to make it safe?—Yes.

4901. Then you find that the watering really does have the effect of making a damp mass around the places, and thus practically removing the dust in its dangerous form?—Yes.

4902. It has been put to us here that the watering in many places does not succeed, but, as Sir William Lewis suggested to you just now, it forms a coating on the top of the dust. Is it your experience that as a rule in South Wales it does succeed?—My experience is that of late years the colliery owners do look after it—the managers at any rate do. They remove the dust very well on the whole, and afterwards they water.

4903. First remove and then water?—Yes.

4904. And they see that the watering is done properly?—Yes.

4905. Then with regard to the question of dealing with the coal dust, the general effect of your evidence is that you think there is no scope just now for taking further precautions?—No.

4906. That is so?—Well, I believe there is a possibility of applying science to the explosives, so that we may get a powder like the lime mixture, which will be effective in doing the necessary work. I am no chemist myself, but I believe that it is possible to apply chemistry to the lime process, and it may be, to the bellite?—So far as I am aware, as I told the Chairman, bellite does not make any flame at all.

4907. You are doubtless aware that the lime cartridge has been in use for many years?—Yes.

4908. Especially in Derbyshire. Has it been used in South Wales at all?—Yes. It has been tried. We used lime in South Wales, I can remember, so far back as 40 years ago, but there were no chemicals mixed with it then, it was used in its natural form—rude—the lime itself only being pushed into the holes at night, and water being put in after it, and against the morning it would squeeze down the coal.

4909. The only difference between 40 years ago and 10 years ago is that it was put in roughly then, and

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10 years ago it was used in the form of a cartridge?—Yes.

4910. But I daresay you know that the lime cartridge is not now in use, except upon a very small scale?—It was tried in Wales as an experiment by Mr. Casey. I saw it tested at Powell Dufferyn, and I thought then that it would be possible to get science applied to it, and to make it more effectual than it was then.

4911. Are water cartridges used now?—Yes.

4912. Are they used in conjunction with powder or with dynamite?—That I could not say.

4913. With dynamite, I suppose?—I know they are used, but it is the exception to use them.

4914. You doubtless know that the water cartridge, as a rule, is used more in connexion with the high explosives than with powder. Were you aware of that?—No; of course I am not so much in the collieries as I was.

4915. Then with regard to the other explosives, such as roburite, securite, carbonite, and ammonite, have they been tried in South Wales?—Only experimentally, I think. The roburite has been tried to my knowledge.

4916. You mentioned that they were not so strong as powder. Would you not say that they were rather stronger than powder?—Do you mean roburite?

4917. Yes, take roburite?—No.

4918. You think not?—The experienced men say that it is not nearly so effectual.

4919. Do you not know that in using roburite they have a smaller hole than in using powder, and that they use a smaller cartridge?—That I did not know, but I know that the men have been trying it for weeks at my suggestion at the Plymouth Collieries in Merthyr, and they gave it up; in fact, they could not go on.

4920. Was that in consequence of the strength or the fumes?—The strength more especially.

4921. It was not strong enough?—That is it.

4922. They could mend that by using more of it, could they not?—Well, that would mean that it would have been much more expensive. I will go so far as to say that it would be 200 per cent. more expensive.

4923. It starts by being twice as expensive as gunpowder, as you know?—Yes.

4924. Therefore, if you have to use more of it, it would be very much higher in working cost?—Yes.

4925. I think you answered the Chairman to the effect that you did not think coal dust by itself would cause an explosion if exposed to a light?—That was my answer.

4926. On that point you differ from Mr. Galloway?—Yes. I believe that Mr. Galloway is going to extremes.

4927. Do the miners in your country agree with you on that point generally?—That is my opinion, certainly.

4928. There is just one other point that I wanted to ask you about, but it hardly bears on this inquiry. You will remember that in the Act of, I think, 1872, an arrangement was made for allowing the colliers themselves to examine the mines from time to time. Is that done in your district?—Yes.

4929. How often. Is it frequently done?—Do you mean the examination by workmen?

4930. Yes?—It is done, but I do not say that it is the rule. I believe now that the majority of the collieries in Wales have been examined by the workmen. My experience is that when we have depression in trade the men give way on that point, and they are not so minute in their examination as they are in the good times, because in the first place the colliery owners can afford to keep the colliery in a better condition in the good times than in the bad times. Then they give way. The men to some extent imagine, no doubt, that if they say the truth about what they see, they would be victimised. And I go further and say that they have cause to be suspicious of the colliery owners and colliery managers victimising them.

4931. But apart from that, generally speaking, would you say that the examination by the colliers has been useful and beneficial?—Yes.

4932. Do they extend their observation to coal dust?—No.

4933. It is more to the general ventilation of the mine, I suppose?—Exactly. I do not know that I have heard even of a report giving any explanation as to the amount of coal dust that they had in the colliery.

The witness withdrew.

Mr. T. D. Isaac.

Mr. Thomas Daronwy Isaac called and examined.

4934. (*Chairman.*) You are president of the Rhondda Valley Labour Association, I think?—Yes, for the present year.

4935. Have you been yourself a practical miner?—I am a miner. I was working last Wednesday in the mines.

4936. How long have you been a miner?—For nearly 30 years.

4937. And have you always worked in South Wales?—Yes.

4938. Are you well acquainted with the mines there?—Yes, I have worked in about a score of them in South Wales.

4939. You have heard the evidence of Mr. Morgan; do you agree with his evidence with regard to the danger of coal dust?—Yes; as to the general danger of coal dust.

4940. Do you think that it can cause an explosion?—I think it does. I think that it will explode in itself when the air is very hot in fiery mines.

4941. And you have no doubt that it will carry on an explosion?—Certainly.

4942. And therefore it is a real danger which ought to be guarded against?—Yes.

4943. Now with regard to the precautions, do you think that watering is a practicable precaution?—Yes; as far as the travelling roads are concerned, but Mr. Morgan did not say anything about the dust which is produced in the faces. Now there is a large amount of coal dust produced in the faces by the working of the coal which it is impracticable to water.

4944. Then what precaution do you suggest might be taken to deal with that case?—I would suggest that the mine should be worked in smaller sections with a fresh current of air for each section, rather than allowing the air to travel over a large section of the colliery to be heated by the natural gases and the natural heat of the mine, and also by the friction caused in the travelling of the air. When the air is allowed to travel over a large area it becomes very hot and polluted, and when coal dust is mixed with that, I believe that it will explode even when there is no gas which could be detected by a safety lamp.

4945. Your proposal to work a mine in sections would add very materially to the cost, would it not?—Yes, in the first instance.

4946. Mr. Morgan told us that he is opposed to the use of flameless explosives because he thinks they would add to the cost and would tend to throw the collieries out of work; but your proposal would go further in that direction, would it not?—I do not know whether it would; it would of course add to the expense of altering an old well developed colliery, but when a colliery is opened upon that system it would not be so material.

4947. Is there any other precaution that you would suggest?—I agree with Mr. Morgan about the filling away of the dust and the watering, but then there is such a large amount of dust. Every inch of the colliery, the roof and the sides and the timber, are covered with dust in very small particles. There is a patent watering tank which would throw the water all over the roof and sides and everything, and I would suggest using that in very dusty mines.

4948. Is that instead of your proposal to work the mine in sections?—No; on the main travelling roads I would suggest the use of that watering tank.

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4949. Not on the faces? — It is impracticable to water the face of the workings.

4950. Even with any kind of sprinkler?—It would be too expensive and impracticable to carry the pipes through the face of the workings.

4951. Therefore the only suggestion that you can make, besides the watering of the main roads and the carrying away of the dust from the main roads, would be to work the mine in sections?—Yes, in smaller sections than many of them are at present.

4952. Each section having a separate ventilation?—Yes, a separate current of air.

4953. In what way would that prevent the danger from coal dust? There would still be in each section a great quantity of coal dust, would there not?—Yes.

4954. Would that not be dangerous?—Yes, it would be dangerous to a certain extent, but not so dangerous.

4955. Is your object to keep it cooler?—Yes.

4956. Is there anything else that you wish to add to Mr. Morgan's evidence?—No, I have nothing in particular to add, except as to the blowing out of shots. My experience is, that there is generally a flame with a blown-out shot.

4957. And that, in your opinion, might lead to an explosion in a dusty mine?—Yes.

4958. But you also have no doubt that coal dust is an additional danger which ought to be guarded against?—Yes.

4959. (*Sir William Lewis.*) Have you seen many blown-out shots?—Yes, many.

4960. You have had some yourself, possibly?—Yes, many.

4961. What do you say is the cause of blown-out shots as a rule?—I should think, as a rule, they are due to too little powder being put into the hole.

4962. Or too little tamping?—Yes; as a rule, I believe it is owing to putting too little powder to blow out the coal.

4963. Or to blow the hard ground?—Yes.

4964. It blows out at the place of least resistance?—Yes.

4965. Did you consider that it arose from inexperience when you had those blown-out shots?—Yes, partly.

4966. Your experience with respect to blown-out shots is not the same as Mr. Morgan's. You say that they generally give off flame?—I believe that the majority of them give off flame.

4967. Have you ever had a blown-out shot fire any coal dust in your experience?—No, I cannot say that I have.

4968. Or fire any gas?—Yes.

4969. Under what circumstances?—I was working with a naked light in a colliery where there was a very thick bed of rock above the coal, and there were some crevices in the rock where blowers would come out sometimes, and when putting a shot in the coal when there was a blown-out shot those blowers would ignite.

4970. You had a concussion with the blown-out shot?—Yes.

4971. And that brought down the gas?—Yes.

4972. And the flame of the blown-out shot ignited the gas?—Yes.

4973. And that was gas alone?—Yes.

4974. There was no connexion with coal dust in that case?—It was not a dusty mine.

4975. That was an open light colliery?—Yes.

4976. Have you had any experience of the water arrangements where they have sprays running along the intake?—Yes.

4977. And where the water is under pressure?—I have seen it at the Mardy Colliery.

4978. Do you consider that the intake is sufficiently saturated with moisture under such an arrangement so as to lay the dust in the faces? — No, I do not think so, because it loses the dampness when it has gone into the heat of the mine.

4979. You still think that that is not sufficient for the coal faces?—Yes.

4980. Then you suggested to the Chairman that the mine should be worked in smaller sections?—Yes.

4981. Have you considered what size sections you would recommend to be adopted in order to reduce the risk of accident?—I would say that a section containing about 50 miners would be a reasonable section.

4982. Then how many splits would there be in a colliery working 1,000 tons a day?—Of course in a colliery where 400 men will be working that would mean eight splits.

4983. Do you suggest that there are only 400 men down for 1,000 tons of coal a day?—That would mean about 800 men.

4984. And that would be double the number of splits?—Yes.

4985. Do you think that would be practicable?—Well, on consideration, perhaps my number is rather too low, but I do believe, from my experience, that some of the mines should be worked in smaller sections.

4986. Have you ever taken the trouble to ascertain the difference in the temperature between the intake and the return in some of the larger collieries where you have worked? You say that they are very hot, and that it is with the view of keeping the air as cool as possible that you would increase the number of splits in working the collieries?—I have not tested the air by taking a thermometer down, of course.

4987. Do you think, as a practical man, that it is the heated state of the returns which is the cause of there being accidents from coal dust in the faces?—To a certain extent.

4988. Now, if that is so, could not the quantity of air passing along those faces be increased in many places; and would not that tend to keep them cooler, better than the adoption of your plan of dividing a thousand ton colliery into 16 splits?—Well, I would not bind myself to the 16 splits now since I have thought it over, but I daresay you are aware that some collieries are working in rather large sections.

4989. It would not be fair for me to pursue this matter, if you say you have not considered fully what would be the effect upon the working of collieries of the adoption of your suggestion to reduce the size of the sections into which a colliery is divided; I suppose you mean the splits?—Yes.

4990. Have you any idea as to the volume of air which is passing through the large collieries in your district?—I do not know; we miners do not generally go into those things scientifically.

4991. I did not know whether, if you had considered it, you had inquired into the volume of air which was really passing along the faces where you say that the watering adopted is practically of no avail?—Not in the faces.

4992. Have you had any experience of other explosives than powder?—Yes, of dynamite.

4993. With what result?—I believe that dynamite is highly inflammable. I believe that there is a large flame with dynamite. I have seen it myself.

4994. Have you used water cartridges?—No, never.

4995. Did you find any difficulty or any inconvenience in carrying on your operations with dynamite?—It is very rarely that I have used it; but I have done so in very strong rock, especially after a blown-out shot of gunpowder. Then we put dynamite in the cracks and crevices made by the powder.

4996. Did you find any inconvenience from the fumes of dynamite?—It was rather worse than gunpowder, especially when the air was very weak, when there was no current of air to drive the smoke away.

4997. (*Mr. Bainbridge.*) Have I understood you rightly, the only reason why you proposed dividing a mine into more sections, was for the purpose of cooling the working face?—Yes.

4998. I suppose you would agree that there is a great difference between the kind of dust that you find in the travelling roads and the dust in the working face, is there not?—Yes, the dust which is on the travelling roads, as a rule, is very small, it has been trampled upon by the men and horses.

4999. And has been caused very much by the movement of the trams running along?—Yes.

5000. It has all to rise, in fact, before it falls?—Yes.

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5001. And therefore is very much finer than the dust in a working face ?—Yes, I believe some of it is.

5002. Which is the most dangerous in your opinion ? —I should say the dust which is on the travelling roads.

5003. Very much more so, is it not.—Yes.

5004. Then would you not find the dust which is in the working face, as a rule, to be somewhat coarse to the touch ?—Yes.

5005. And would you not also find that the working face which you had on the Monday has quite changed its position by the Wednesday or the Thursday ?—Yes.

5006. You are constantly going forward, are you not ?—When the coal has been squeezed, it is more dusty, of course.

5007. I mean it is not as though you had a travelling road which may last for 10 years; the working face changes its position, does it not, every few days ?—Yes.

5008. It is constantly going forward ?—Yes.

5009. And therefore the risk of dust in the working face is very much reduced, is it not ?—Yes.

5010. Then when you come to the question of sections, you say that the reason you aim at making the mine into more sections is in order to get the air cooler. Now, take the case of a mine with 200,000 cubic feet of air, and having five splits, that would be 40,000 cubic feet in each, would it not ?—Yes.

5011. If you reduce each of those splits from 40,000 cubic feet to 20,000 cubic feet, thus making 10 splits, would that not have the effect of making it rather less cooling in its power by reducing the volume; in other words, would not 20,000 cubic feet passed round a face have less effect in cooling than 40,000 cubic feet ?—Yes, but it would not carry the dust so far in a small section as in a large section.

5012. Do you mean the less volume would carry less dust ?—Yes.

5013. That was not your point, your point was the heat, you know; you said that if the mine was divided into smaller sections you would have less heat in the air ?—Yes, the air would be, in my opinion, not so hot, and it would not carry so much dust as a stronger current.

5014. I put it to you, if you pass round a working face 20,000 cubic feet in place of 40,000 cubic feet, you would have rather more heat, would you not. I think probably one answer I might put for you would be that the effect of making more sections in a mine would be to reduce the length of the current ?—Yes.

5015. In that way your argument, perhaps, would have some weight. Which colliery, may I ask, are you working in now ?—I am working at the Treorchy Colliery, but what I say here is not applicable to that colliery alone, but to my general experience.

5016. I quite understand that, but I put it to you that in every well laid out colliery now, whether in Wales or elsewhere, as you are doubtless aware, it is the practice to divide the mines into sections ?—Yes.

5017. As far as possible ?—As far as practicable.

5018. Every colliery manager lays out a colliery now with a view, as far as possible, of cutting it up into sections ?—Yes.

5019. But you think that might be developed still further ?—I should think it might.

5020. Do you not think it possible that in some of the modern mines the division into sections is fully carried out now ?—Well, yes.

5021. Then I take it that you differ from Mr. Morgan not only with regard to the blown-out shots, but with regard to the coal dust sometimes causing an explosion itself without gas ?—I believe it would, because I have experienced it myself, especially when going on a main travelling road after a train of coal, when I have noticed the dust in the gauze of my lamp igniting, something similar to a slight explosion of gas.

5022. You have noticed the dust in your lamp ?—Yes.

5023. But your experience does not go beyond your lamps with regard to that ?—No.

5024. Is it your impression that any recent explosion in Wales, say any explosion within the last 10 years, has been caused by coal dust alone ?—No, I cannot say that that is my experience.

5025. You have no colliery in your mind where that has been the case ?—I believe that it added to the destruction caused by the explosion at Mardy Colliery, where it was found that the explosion was carried from one district to the other with the current of air.

5026. Is the mine you are now working a dusty mine ?—It is rather dusty.

5027. Do you take precautions to wet the dust ?—Yes, the dust is watered on the main travelling roads and filled off.

5028. I would like to ask you a few more questions about these blown-out shots, because it is not often that we have the advantage of having an actual collier with us. Could you tell me when you had the last blown-out shot ?—I have not been using powder for the last 10 years, not to any extent.

5029. Then you have not been subject to blown-out shots recently ?—Not recently.

5030. Did you find that as your experience as a collier went on you got more and more power to prevent blown-out shots ?—Yes, according to how near we could guess the amount of powder to be put into each hole.

5031. It is a question of judgment ?—Yes.

5032. Formed upon past experience ?—Yes.

5033. Did you find that you got fewer blown-out shots as you got older ?—Yes.

5034. You did ?—Yes, as you learn the nature of the ground and the strength of the explosive you get more experience.

The witness withdrew.

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Mr. John Forman called and examined.

5035. (*Chairman.*) You are the president of the Durham Miners' Association, are you not ?—I am.

5036. And you have had an opportunity of studying the question of explosions in mines ?—In some degree.

5037. Have you come to the opinion that coal dust plays an important part in some of these explosions ?—Very decidedly.

5038. Now would you explain to the Commission how, in your opinion, the presence of coal dust operates either in creating or in extending an explosion ?—Coal dust must be present in the immediate neighbourhood of a shot.

5039. Do you think that anything depends upon the quality of the coal dust ?—Certainly; dry, fine coal dust.

5040. Then if there be a blown-out shot in the presence of a great quantity of coal dust what do you think the result is ?—There is more flame. I have been a stoneman many years, and I know that we sometimes have a quantity of flame from an ordinary shot. In my opinion an ordinary strong stone shot is equally as dangerous as a blown-out shot if it is overcharged.

5041. In either case I suppose it disturbs the coal dust which is in front of it ?—It requires a certain amount of concussion, of vibration of the air, to throw the fine dust into the air.

5042. But in order to make an explosion there must be a flame, must there not ?—Yes, there must be a flame.

5043. Therefore you require a blown-out shot ?—I think that an ordinary strong shot, if it is overcharged, gives flame as well.

5044. And in either case sufficient to cause an explosion ?—In either case; all that we want is flame, and in my own experience, if a shot is overcharged we are almost certain to have flame from it.

5045. Then supposing there is either an overpowdered shot or a blown-out shot giving flame, and that this ignites the coal dust in the immediate vicinity, what happens then ; how is the explosion carried on ?

—Then the particles of coal dust, if finely divided and surrounded with air, ignite each other and generally extend, and the temperature rises. It is my candid opinion that the temperature rises until the temperature is such that coal dust will explode. If it is not digressing, I would explain that there is a certain temperature required to explode coal dust by itself. The people who are against the coal dust theory do admit that it inflames. I have talked to many mining engineers, to a large number in our county; we have talked the thing over many a time, as we are meeting every day on business, and they admit that it inflames. So the only point between us is will the temperature rise until coal dust will explode right away? Now I may say that I have tried that on a very small scale. One night when I went home from the Seaham Colliery I took some of the curve dust home with me, and I had a very bright kitchen fire, and put everyone out of the kitchen; and I had two long rods, about 6 feet long, and put about a quarter of a pound of the dust in a bag, with the mouth open; and I reached over to the fire and put it on the fire; a bright flame came out about 6 feet instantly and singed the front of my coat. You can try that experiment at any time, and you will find that I have correctly stated the result. It only wants a high temperature to explode it, that is my opinion.

5046. Then I think your idea is that the first effect of the shot is to disturb the coal dust and ignite it?—Yes.

5047. And then the heat gets up and an explosion follows?—Yes, the temperature rises to such a height that it explodes.

5048. And that explosion may be carried on for any distance?—As long as ever there is any dust in the air to feed the flame, it continues.

5049. Do you think that a quantity of coal dust in the air in the ordinary working of a pit is sufficient to explode?—No.

5050. It must be raised from the ground?—It must be raised by a shot, and there must be a large quantity of fine dust adhering to the sides, and the timbers and the floor; there must be a quantity of dust floating in the air before it will ignite. I have tried it myself. I was 15 years a deputy overman in the mine, and I have many a time taken notice with my light when I have been coming out in a non-fiery mine.

5051. (*Mr. Bainbridge.*) Which mine?—In Pease's West Collieries. A small quantity of dust floating in the air will not have any effect. There is another thing, it flies in a horizontal direction. In my opinion that is quite altered by the concussion of a shot. I believe it gets an altered motion, and that the motion which seems to give an impetus to the inflammation of the dust is quite different from the dust flying horizontally in the air.

5052. (*Chairman.*) Does the explosion follow the current of the air or go against it?—I might put it this way. If you ignite coal dust near the shaft it will go with the air if it is inbye; if it is in the return or outbye it will go against the air. We have experience of coal dust going both with the air and against it. It depends upon where the location of the ignition is and the track of coal dust.

5053. You have had practical experience connected with several great explosions in your neighbourhood, have you not?—In the case of the Seaham explosion I was there for 12 months as an explorer. The late Marquis of Londonderry sent me this letter, if you will be kind enough to read it (*handing in letter*). I was there 12 months, and was almost every day down the pit.

5054. It appears from this letter that you undertook the work of exploration afterwards or represented the Miners' Association?—The explosion happened early in the morning and I went down that night, and I was there for about 12 months until the last body was found. I might say that the first night I was down I got after-damped. We got into what were called the Maudlin Stables. Mr. Stratton, the manager, cautioned me that I was rather rash. I thought I heard a noise and I thought it might be somebody alive. I went then to the stables and I got carbonic oxide or else after-damp, and my head turned all dizzy and I lost a good deal of my energy. Mr. Tait, a mining engineer, said to me, "I will assist you, it is affecting you." "Yes," said I, and so he took me up by the belt and we were all affected more or less. Mr. Stratton, the manager, was very much affected. I was obliged to go home, and I was not down again for two nights. That was on the Wednesday night, and on the Thursday and the Friday I was obliged to stay at home, I was so unwell, and then I returned there on the Saturday again.

5055. Therefore you were there so soon after the explosion that you had every opportunity of seeing the state of the mine?—Yes.

5056. To what do you attribute that explosion?—To Brown and Simpson's shot.

5057. That is to a blown-out shot?—No, it was not a blown-out shot.

5058. An ordinary shot?—An ordinary shot in the stone. They were widening a refuge hole.

5059. Was it a gas explosion?—No, a dust explosion; there was no gas; there could not be any gas there; it was only about 150 yards from the shaft.

5060. Your reason for saying that there could not be any gas is that the ventilation would prevent it?—There were 320,000 feet a minute coming down that shaft, a current of air in which no gas could possibly exist.

5061. Do you think it was wholly a coal-dust explosion?—Yes.

5062. The explosion you are speaking of occurred in 1880, did it not?—Yes; there was also one at Seaham in 1871, and if you will permit me I will draw your attention to that. That was an explosion near about the same place in that stone drift. The late Mr. Crawford himself went down and examined the mine. You will remember that he was a member of Parliament for one of the Durham divisions. He went down himself, and I was his colleague. He was a capital pitman, and he was a man who had a lot of tact about him. He said to me, "John, I never was so much puzzled in my life; "here is an explosion happening at Seaham Colliery, "and I find there is no force exhibited for about a "hundred yards up to the man at the engine, and then "the indications all seem inbye over." He had no idea of coal dust at that time, not the slightest, and he was at a loss to account for it, he could not imagine how the pit could explode.

5063. But your opinion is now, with your present experience, that that also was a coal-dust explosion?—Yes; and I will give you my reason why I think so. In 1876, I think it was, I read Mr. Galloway's book on coal dust, and it occurred to my mind that that explosion might have something to do with coal dust. So I went down to Seaham and I saw Simpson, the father. He and his son fired the shot; the son was killed; Joseph Simpson, the father, was burnt, but he got out alive. Now, I said, "Simpson, will you tell me "exactly what happened when you fired that shot?" I said, "I am afraid coal dust has got something to do "with that." "Ah, man," he said, "no small coal "ever fired a pit,"—he could not comprehend such a thing—"but I will tell you exactly how it happened." He said they commenced to drill this hole; he had his son, who was learning to be a stoneman, with him; and after he got the hole drilled he was very cold; the wind was blowing past like a hurricane, and he had a new flannel jacket in the pit that night, and he put the collar up to keep the wind off him, and the son lit the match. The father went down to the Maudlin junction, about 40 yards down, and left the son to light the match. The father stepped across so that he could see the match burning. He saw that the engine lamp was burning bright and beautiful in his face in a straight line with him as he was standing watching the match. He said the engine man's naked light was burning, and as soon as ever the shot went off a dark red flame came down from the shot and covered him up; it went off him at once and flew into the man at the engine. Now, there were 79,000 cubic feet a minute passing that man. Mr. Crawford scarcely could believe it; and when he went down the pit he measured the air himself after the ventilation was restored, and found it to be 79,050 feet, 50 feet over. Now how on earth could gas accumulate there? There was no gas to come down or ignite at the engine man's lamp. It could not possibly be anything but dust.

5064. Then, to continue your own experience, I think you had something to do with examining the pit after an explosion at Trimdon Grange?—I did not examine it, but I went down to satisfy myself as to the nature of the roads. We had two men there, Mr. Wilson and Mr. Wilkinson, as explorers, but I did not explore it. I came to the conclusion that the explosion occurred in

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what was called the Headways district at Maitland's place. Mr. Wilson told me himself that he was in there and found Maitland; and there was a mining engineer there of the name of Bell, and Bell said to Mr. Wilson, "It is a flushed kitty." The pricker had been drawn from the hole, but the straw had been put in and the shot lit up. It was very near a goaf, and no doubt a little gas had escaped out of the goaf somehow or other to this place, and a little straw had ignited a small portion of gas and raised the dust. In my opinion that was the cause of the explosion. Here is a very important thing: Maitland was burnt, but inbye side of Maitland there was no exhibition of force. The cloth brattice was burnt outbye side a little; and there were five men working close to him, inbye side of him, who died through after-damp, who were not singed or burnt at all. I think the coal dust had taken fire and gone away out along the Headways.

5065. Did it go far?—Yes; it went out of the Headways district right down to the shaft, and it passed what is called the Croscut district, and then it went into the Narrowboard district.

5066. In its course might it have taken up any gas?—I do not think so, because it was all on the intakes. I could not see where the gas could come from. But allow me to direct attention to the Croscut district. This district was damp and wet, and I think about 60 yards of the road was laid with ash ballast, but the explosion never looked at that district.

5067. The explosion did not pass there?—It never looked at it. The men all got out there—a good many alive, but some of them succumbed to the after-damp when they got near the end of the district. Those who got out alive, got out before the after-damp caught them.

5068. Then will you go on to the next explosion which you examined, which was Tudhoe?—I was simply down there to view, and I made no examination. From all the information that I could glean, that explosion occurred by two stonemen firing a shot on the Sunderland engine plaue, or near to the engine plane.

5069. Were the circumstances similar to those of the explosions you have previously described?—Similar. There was not one of those explosions extended beyond what we call the landings, except one down the Elemore pit, which went a little further than the landing; they all stopped at the landing, where the dust is supposed to be scarce.

5070. In all these cases, your reason for believing that coal dust was the prime agent is that the ventilation was so good that you think there could not have been any gas?—There could not possibly have been any gas.

5071. Does that apply to the other collieries you have named in your proof, namely, West Stanley, Usworth, and Elemore?—Yes. If you will look at the plan of Usworth you will see that the explosion went inbye. A very curious thing happened there. In the Middle North the stables were rather damp, it did not pass them, it went no farther. In the district above that, what is called the Low North, which was a dry and dusty road, it went right into the face. Now the Hitch North above that again, inbye over the next branch, there was water brought out of the Narrowboard district and pumped down there into the Hitch North; and it is wonderful that the explosion scarcely interfered at all with the Hitch North, the road being damp and wet. Just above the Hitch North there is another branch which goes off, which has a double intake. If that had been a gas explosion that is the very place it would have gone into, but it never touched it, it never looked at it; there was no dust. If we go to the outbye side, we find in going up to the shaft, a direct line into what they call the Low Lawson Way. In that way there was little or no dust, and it went off at an angle to the shaft. Then the Bramston Way, an old disused way, it never went into, except for a very little distance.

5072. In every case then, it seems to have followed the dust, and to have avoided the damp?—It followed the dust.

5073. And avoided the wet?—Yes.

5074. Have you considered what precautions ought to be taken against this danger?—Will you permit me to point out to you the circumstance which attends all these explosions which we consider to be dust explosions. In every one of these dust explosions there is no force exhibited for about 60 to 80 or 90 yards on each side of the shot, none whatever.

5075. The explosion gathers force as it goes on?—Yes. The drilling gear—light articles—in all these cases is set up against the wall, and there is no force exhibited for about that distance. The pricker is a very light thing; that and the others are left standing, never stirred or touched, which shows that the ignition is simply an ignition of the particles of dust to begin with without much force.

5076. Then it gathers force as it goes on?—It gathers force. In all these cases there is no force exhibited which can be perceived at the beginning. Now, I may be wrong, but I think if it had been a gas explosion, force would have been exhibited at once, at any rate, much quicker.

5077. Then I will come now to the question I asked you. What precautions do you suggest should be taken to avoid this danger?—I think that the 12th General Rule is a very good rule, but I think that the 4th General Rule ought to be amended a little.

5078. In what way?—It points out that there must be a report that gas is seen. Now, I think it would be well if that could be amended so as to require a report to be put on record when there is an accumulation of coal dust. There are deputies going about, and the back overmen and the overmen are travelling the mine every day, and they can see whether there is an accumulation; and I think they ought to be made to look after coal dust as well as gas.

5079. Would you require the coal dust to be removed?—Where there is any great quantity of it, it ought to be removed, I think. I think the owner would do that himself if his attention was drawn to it.

5080. Do you think that there ought to be any systematic watering?—Yes, especially in the intake roads.

5081. It is not practicable, is it, to water the faces?—No, it is not; but I do not think there is any great danger in the face. If there is a special accumulation of dust and a shot is fired, or a small portion of gas is fired, there might be a danger there; but in general the working face is comparatively safe, I think.

5082. Watering, then, should be confined to the main roads?—To the main roads, or to any special place where there is an accumulation of dust.

5083. Is any alteration of the law required?—I think the general rules are very good if properly carried out, with a little addition to General Rule 4.

5084. It only wants a little more attention to the matter on the part of managers and mine owners?—Yes, that is all. I may say that within my own knowledge dust was at one time taken no notice of whatever. Mr. Stratton himself told me at the time of the Seaham explosion that they never took any notice of the dust.

5085. But they do now, do they not?—Yes.

5086. Do you think any alteration ought to be made in the system of blasting—of getting coal by explosives?—I think these high explosives are much safer. We use roburite and tonite. I am not an authority on this matter, but they are considered much safer. I think gunpowder is very dangerous.

5087. Would you prohibit gunpowder altogether?—I would prohibit gunpowder.

5088. (*Mr. Bainbridge.*) When you say you would prohibit gunpowder, do you refer to the county of Durham?—Yes.

5089. Your knowledge does not go beyond the county of Durham?—No, just the county of Durham.

5090. For instance, if you go as far as Northumberland, even in the mines which have gas there, would you prohibit gunpowder?—I think that is dangerous, but I am speaking of our own county.

5091. In other districts where the coal is much harder than in Durham—of course Durham is famous for having more soft coal than hard—would that not be the means of stopping the working of coal?—I think the other explosives are just as handy in our county as powder.

5092. Are you supposing now with regard to the other explosives that they are flameless?—I am not an authority on the matter, but I suppose they are very much safer.

5093. Do you know that taking the whole number of them—and there are about eight altogether—there

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appears to be somebody who at some time or other has seen a flame from nearly all of them?—There is a question arises there. I suppose there are chlorines in roburite and there is sometimes a scintillation, but I think it is scarcely a flame. I may say that we have had an inquiry by Professor Bedson and two doctors into the facts of roburite, as the men complained about it.

5094. About the fumes?—Yes. We had a committee formed of the mining engineers and ourselves; and the Government inspector, Mr. Bell, was in the chair. We had a quantity of shots fired, and I took particular notice of the firing of these shots, and I never could detect any flame. I think it gets the coal just as well as powder.

5095. While you are on that point will you give us the conclusions arrived at by that committee on the question of the fumes?—They found that there was nothing injurious.

5096. Only unpleasant?—It was only unpleasant; there was nothing injurious. The doctors were two very able men, Dr. Drummond and Dr. Hume.

5097. There is the general feeling amongst the miners in Durham now that an explosive like roburite is safer than gunpowder, or safe in itself?—We had a lot of contention to begin with to put it down, but I think that all quietly settled down after this committee sat and made a report.

5098. We quite, perhaps, agree that roburite is safer than gunpowder, but it is generally thought that it is safe by itself; that is, absolutely safe in firing where there is gas?—I could not say absolutely.

5099. Is it used now at Seaham?—I am sure I could not say. They use roburite at Hetton, and tonite at South Hetton. I could not say what explosive they use at Seaham, but I believe they use roburite.

5100. At any rate, it would be thought generally safer than gunpowder?—Yes, much safer.

5101. Even if you were prohibiting gunpowder, you would not extend that prohibition to these high explosives, would you?—No, certainly not.

5102. So long as the people believed they were safer than gunpowder or absolutely safe, you would approve of their being used?—I think some mines could not be worked without some explosive.

5103. Is there much gunpowder used in Durham now?—In the western portions.

5104. Where there is very little gas?—Very little; in fact, no gas at all.

5105. Your prohibition would hardly apply to the mines where there is very little gunpowder used?—No.

5106. Take the eastern pits of Ryhope, Seaham, and South Hetton, there is very little gunpowder used there now?—None at all. There is some at Haswell, I think; that is all.

5107. They stopped using it because of the danger?—Yes.

5108. And partly because the coal is not very strong?—Yes. Every precaution is now taken that can be taken, and while some of our important mining engineers will not exactly give in to the coal-dust theory, yet they are very careful, extremely careful.

5109. Now, you spoke about Rule 4. I daresay you had in your mind that the Mines Act does provide for precautions being taken with regard to coal dust?—Yes, but there is no rule as to the accumulation of dust. There must be a report that gas is found, but I think that dust is more dangerous than gas.

5110. You are now speaking on the question of reporting?—That is all; to put on record that at such a place there is an accumulation of dust.

5111. You have not forgotten that there is a clear provision made for removing coal dust before firing a shot?—Yes, but there is no provision made to report or to make a record of the accumulation of dust. I think if there were such a provision it would do a great deal of good.

5112. In the absence of that provision in the Act the managers of collieries like Seaham are taking great care, I suppose, to have the coal dust removed, are they not?—Yes, they are taking every care now in these deep fiery collieries.

5113. Especially those deep collieries in the east of Durham, where there is most coal dust?—Yes; but you see if they had a record of dust, that would make every-one vigilant; and then it would be always before their minds in reporting.

5114. I take it from your knowledge of these explosions, there have been very few working miners in Durham who have had more experience than you have?—I think not.

5115. Have you given your evidence to-day as your own, or after conference with your council?—Just my own. You cannot get working men to believe that there is much danger in coal dust. They require to have a superior intelligence to study the matter out and to look at it from every point, and you cannot get them to do that. The most intelligent people think there is some danger in it, but the others have no dread about it.

5116. You gave us several instances in your evidence to the Chairman about the effect of a damp district; have you any idea what width of dampness would be enough to arrest the force and extension of an explosion?—My opinion is that it must feed as it goes, and if there is no dust to feed it, it is done at once.

5117. At once?—Yes.

5118. A few yards would be enough?—Yes, a few yards. Of course, the force of the explosion may extend a little further, but the flame must be done. I think it is fed the same as the gas flame, but the one is immensely quicker than the other.

5119. In reference to your earlier answer to a question about blown-out shots, you mentioned a stone shot very often being as dangerous as an ordinary shot; of course you meant if it was blown out?—No, doing its work, but if it is overcharged.

5120. (*Sir William Lewis.*) A strong shot?—A strong shot.

5121. (*Mr. Bainbridge.*) So strong as to produce flame?—Yes, a concussion. There are some shots comparatively safe; they cause a little concussion, but there is not sufficient dust thrown into the air to do any damage. I have seen scores of shots fired of that description, side shots where there has not been a fast, or what we call a sumping shot. There is not a larger amount of concussion with those fast shots, and it requires a concussion to drive the dust into the air. It takes a large amount of dust, I believe.

5122. Have you at all, in your experience in Durham, seen the effect of trying to wedge the coal down as compared with the effect of explosives?—Yes.

5123. Have you seen the effect of a feather wedge?—There is a man of the name of Mr. Ramsay, the under-manager at the Tursdale Colliery: we were all down there to make an examination of roburite, and he had the juds carved all ready to fire the shots. Now, we observed, when we had these places all ready, that there was coal dust all along, and we had a conversation with the Government inspector as to whether it would be safe to fire shots there. Mr. Ramsay with his wedge wedged two or three of those juds down to see how it acted, and it laid the juds at once in a solid piece of coal.

5124. What seam was that in, the Maudlin?—I am sure I could not say.

5125. Was it a hard coal?—Yes.

5126. Is the wedge used now extensively in the county of Durham?—I do not think so.

5127. But if it answered so well there why should not it be used more?—It answered well, but it is very heavy work, I suppose.

5128. The hammering of the wedge is so severe?—Yes, to get in; they think that roburite is safe and they use it.

5129. It is much easier?—Yes.

5130. I should like to ask you a question I asked a witness from South Wales. You will remember the provision of the 1872 Act as to colliers examining a mine. Is that carried out in Durham much?—Yes.

5131. In both the east and the west?—Yes.

5132. Does that examination extend at all to coal dust?—No, just to the ventilation and the roof.

5133. But it is for the purpose of seeing anything that the men would like to draw attention to?—They

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would laugh at it if you asked them to examine for coal dust.

5134. They are getting improved now-a-days?—Yes, they are.

5135. You as rather being the head of the men, when you are counselling them, would you advise them to report if they saw coal dust in too large quantities? —We do not like to advise anything of that kind, because we like to keep the peace as much as possible. When you arouse the ignorant mind upon a certain thing you do not know to what extent it might go.

5136. No doubt the evidence of those cases which you have mentioned here, and the indications that they most likely arose from coal dust, have been brought before the general body of the men in Durham?—No. Reference has been made to coal dust, and people's opinions expressed, but there has been no general consultation. I think we thought it would not be wise to call a meeting of the men and put any theory forward and ask them to sustain it, or do anything in that direction. We thought it might make mischief.

5137. Taking your evidence generally, should I be right in summarising it by stating that your own strong personal view is that coal dust by itself is able to form an explosion without gas, and that where there is a small quantity of gas the presence of coal dust very much stimulates and increases the power and danger of an explosion?—That is so.

5138. (*Sir William Lewis.*) What extent of coal dust would you consider it necessary to report, if it was thought desirable to include dust as a thing to be reported upon in the same way as gas is reported by your deputies?—I could scarcely give you the exact quantity; but where dust is likely to accumulate so that it can be easily observed, if the accumulation is very much about the timbers or sides, and if there is a quantity on the bottom, then it should be reported. There is very little dust to be found on the face of the workings.

5139. I think you said that you did not consider it was necessary in the face; but still you must have in your mind some idea of the quantity. Suppose you were the person examining these places, and you were carrying out what you were suggesting, what amount of dust would you regard as being necessary to be reported upon?—Anything in special places that seems to be a greater accumulation of dust than is found in the ordinary working faces, I say should be reported on.

5140. But would it not be better, instead of reporting it, to take means of removing it as far as possible, or of laying the dust with water?—You see there are so many things passed over; a man going about to examine for gas is not examining for dust, and no doubt if those places were watered they would be all right; but they do not water the face.

5141. Have you any means of watering in your collieries in Durham?—Yes, there are means of watering, but I do not think any faces are watered.

5142. I think you have just stated that you do not consider any accumulation in the faces to be attended with danger?—No, except in special places. We will suppose there is work going on in this direction (*illustrating*), and down *here* there is an engine plane working round to the shaft; the air comes in *here*, and at *this* place there might be an accumulation of dust; and there might arise a small ignition of gas, and a blown-out shot might raise a cloud of dust *here*, and take it right on to the engine plane.

5143. Are you speaking of a working place?—Yes.

5144. If you were using explosives in the working place, is it not incumbent on someone or other to examine that place before the firing of the shot, both as regards gas and also as regards dust?—I am not sure as regards dust that that is examined for.

5145. Is it not? "If the place where a shot is to "be fired is dry and dusty then the shot shall not be "fired unless one of the following conditions is ob- "served, that is to say, (1) unless the place of firing and "all contiguous accessible places within a radius of 20 "yards therefrom are at the time of firing in a wet "state from thorough watering, or other treatment "equivalent to watering, in all parts where dust is "lodged, whether roof, floor, or sides;"—I am reading now an extract from the Act—"and (2) in the case of "places where watering would injure the roof or floor, "unless the explosive is so used with water or other "contrivance as to prevent it from inflaming gas or "dust, or is of such a nature that it cannot inflame gas "or dust." If those provisions are carried out in connexion with all shot-firing in collieries where safety lamps are used, is it necessary to make any such report as you suggest as to dust?—I think so, because we might imagine a case happening without a shot being fired. We will suppose it is a working place, and through some defective lamp a small body of gas gets exploded. You see the dust is there——

5146. We are dealing first of all with shots, with the effect of shot-firing in places where there is dust?—That may be, but I do not think it is carried out in the face.

5147. Then you are assuming that this rule is not strictly carried out?—I think in the face it is not, there is no examination made. I have been a deputy myself, and I know there is no examination made in the working faces.

5148. You are speaking of your own district, of course?—That is so.

5149. And therefore I infer from your answers that these provisions are not strictly carried out. Then I think you said to Mr. Bainbridge that wherever the dust is it requires a large amount of dust to produce an explosion?—I think so.

5150. Have you followed the experiments in different parts of the country with respect to coal dust?—I have read about them.

5151. Has your attention been called to the experiments at Chesterfield?—Yes.

5152. Have you any explanation to give as to how the committee failed to obtain an explosion in the absence of gas?—I may say, before I answer that question, that I was invited to Garsford Hall at the experiments by the Accidents in Mines Commission, and Professor Abel at that time, now Sir Frederick Abel, took great interest in me and showed me all the experiments. Then I was invited down to Harton Colliery, under Mr. Lindsay Wood, and saw the experiments there; and I have read about the Chesterfield experiments. I think all these experiments were upon too small a scale. I think it was Dr. Woollaston, a Mr. Tennant, and Sir Humphrey Davy who proved that even gas with a proper quantity of air in it would not explode in a narrow tube, and I think that the same law is obeyed with regard to the dust. I think the apparatus was far too small.

5153. They produced an inflammation, not an explosion, and the distinction which I wish to draw your attention to is between an inflammation of dust and an explosion; and I ask whether it is not possible that some of the explosions which you attribute to dust may not be attributable to the particular shots relieving gas, and by that means produce an explosion?—I could not possibly conceive where any gas could come from in the Seaham explosion; I examined every yard of that intake—I was there a year—and there was nothing that could be found wrong.

5154. Do you suggest that it is impossible that gas may not be lying in the adjoining strata, and that the effect of a shot might be to relieve that gas and bring it down into the intake?—I think not in our county. There are no strata in that condition in our county; it is all solid.

5155. Have you never experienced gas in rock?—I have not; in our county we cannot conceive anything being in the roof.

5156. Then in your experience you have never known gas in the rock?—I have never known gas in the rock, I have had no experience of it. You asked me about the Chesterfield experiments. I say that I think the concussion of a small horse-pistol was a very weak concussion; when they fired two horse-pistols they got a flame.

5157. That was not what they found?—I think so.

5158. It is only fair to tell you that I am referring to an answer that was given here, and that I have the report in my hand. I think it will be found that your memory is defective on that point. Have you any suggestions to make to the Commission as to the further experiments necessary to set this matter at rest? Do you consider, as you have stated, that all previous experiments have been on too small a scale?—I think this Commission ought to make experiments to prove

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the thing. I think they will find that coal dust is a dangerous agent, and I think that the Commission ought to settle the question.

5159. Now, as an experienced man, what dimensions of gallery, and what length, do you think would be sufficient to place this question beyond a doubt?—I think that you ought not to have the gallery less than a quarter of a mile long. For this reason, that the ignition takes place first, and then you will see how the force increases and its momentum. In all these trials with their various apparatus they only go the length of the inflammation; they never go to the point where coal dust becomes explosive with the high temperature. I think that is an omission in all of them. I think if you had a gallery a quarter of a mile long, you would be able to ascertain the effect after the ignition, and after the force arises. I have sometimes thought that the high temperature raises gas. There is very dense gas with great heat, called olefiant gas. I believe this gas is generated, and that is the ultimatum of the explosion.

5160. What sized gallery would you suggest?—Not less than 50 feet, because the intakes are generally about 54 feet; say from 50 feet to 60 feet.

5161. Then as nearly as possible, you would endeavour to introduce the same conditions as exist in an underground mine?—Yes.

5162. Have you considered how that could be carried out?—I think an artificial gallery built at bank is the best thing; then you are clear there of gas. I think this Government is entitled to great credit for appointing this Commission. It is a serious matter. In my readings of the history of explosions, I have come to this opinion, that a tremendous amount of damage has been done by coal dust, and lives lost in consequence.

5163. You do not think experiments could be carried on in some disused mine?—They might be carried on there, but they would not be so satisfactory. If you were clear of gas entirely, I think that would be most satisfactory; no one would then be able to say, "how do you know there was no gas there?," and so on.

5164. Is there much difference of opinion among the working men in your district as to the effects of coal dust?—There is scarcely any opinion about it among the common run of working men; they cannot see it. The more intelligent of them think there is a danger.

5165. But the greater number do not believe in it?—It is only just within these last few years that our mining engineers have been coming to it.

5166. I wanted to have an answer with respect to the workmen in general. Are they still under the belief that there is no danger attendant upon firing shots in dry and dusty mines?—You see they scarcely have any belief either one way or the other; they never think about it. I believe.

5167. (*Mr. Bainbridge.*) Are you acquainted with the apparatus which is being fixed just now on the Tyne by a committee formed in Newcastle?—I have heard that such an apparatus is now in operation at Hebburn Colliery.

5168. It is being made now?—Yes.

5169. Have you heard what are the dimensions of the gallery which is being made?—No, I have not.

5170. As a matter of fact the tube they are putting up is about 3 feet diameter?—That is too small.

5171. You think that would be too small?—It is too small to try coal dust experiments in, but it may be large enough for proving the explosives.

5172. Will you say precisely why you think it is too small for the coal dust?—Because I think there ought to be room for the expansion of the dust, and for the motion.

5173. It is not a very confined space—3 feet?—No, ut that is vastly different from our ordinary roads and haulage roads, which are 50 or 60 feet.

5174. (*Sir William Lewis.*) Do you think people will not believe at all as to the results, unless you have practically the same conditions as are in an underground mine?—I think it would be most satisfactory to have the conditions as near to those of an underground mine as you can get them.

5175. (*Mr. Bainbridge.*) I will put it rather in another way. Supposing the experiments at Hebburn Colliery on the Tyne with a 3 feet tube show the danger of coal dust as clearly as you have it in your mind, then it would not be necessary, would it, to make the experiments on a larger scale?—So far as I am concerned, it would not.

The witness withdrew.

Mr. Samuel Woods called and examined.

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5176. (*Chairman.*) You are president of the Lancashire Miners' Federation, I think?—I am.

5177. How many members have you?—42,000.

5178. You are also vice-president of the Miners' Federation of Great Britain?—Yes.

5179. With a membership of how many?—About 178,000.

5180. Have you a practical acquaintance with coal mining?—Yes.

5181. Where did you gain your experience?—In Lancashire.

5182. Have you worked for long there?—About 22 years in the mine. I went in when I was seven years of age.

5183. Has your attention been called to the question of coal dust as an element in explosions?—It never was called to it in connexion with the explosions until recently, though I have been quite conversant with the action of dust in coal mines all my life.

5184. What opinion have you formed on the subject?—My opinion is that it may act as an auxiliary or an intensifier upon an originated explosion.

5185. Do you think it can initiate an explosion?—Certainly not.

5186. What are the grounds for that opinion?—In the days of my mining life I have been in all kinds of mines, the most dusty mines imaginable, where gunpowder was used *ad libitum*, and yet I never saw the slightest trace or danger of an explosion arising from dust.

5187. Have you read any account of the experiments which have been made?—Yes, I have read Mr. Hall's experiments and others of the witnesses who have given evidence before this Commission.

5188. What is your general answer to their arguments, which go to show that a blown-out shot may start an explosion if there is coal dust present?—I do not think that there is any analogy between the position of the experiments and the position of a coal mine.

5189. Are you acquainted with the history of the explosions in the Durham district at the Seaham mine and others?—Only by reading the reports.

5190. We have had evidence to-day, for instance, from one of the officials of the federation in the north to the effect that in the Seaham explosion the ventilation was so good that it was absolutely impossible to suppose that there was any gas at the time of the explosion, yet a very dangerous explosion took place?—Of course we have had the same experience in our Lancashire collieries during the last 20 years in a very remarkable way. It so happens that where we have had the most fierce explosions it has been the most ventilated. I am now speaking of the 9 feet mine, such as the Moss pits, Brynn Hall, the Queen pit, and a number of others.

5191. In those cases do you attribute the explosion entirely to gas?—Yes, I believe that the nature of the gas in the 9 feet seams is entirely different to that of most mines. I believe it is not as easily perceived with the lamp. I believe it travels with the ventilation, and is therefore more likely to escape observation, and that renders it less difficult to deal with.

5192. Do you mean that in a case in which gas was not apparent you would still say that it probably was the cause of the explosion?—I think that in those cases the gas being not as easily observed in the Arley mines, the low mines, it has escaped the attention of those who have had to deal with it; and the mine making gas it has gone along with the ventilation, and perhaps in some cases come in contact with the naked light; in other cases it has been the result of a blown-out shot or a

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shot by powder, and that is how the explosion has been caused, I believe.

5193. But when an explosion is caused you think that it may be extended by means of coal dust?—For a short distance I should think.

5194. Have you any actual experience or knowledge on which to base your conclusions, or is it only theory? —Yes; about 28 years ago, when I first took the part of a collier, I was working in a mine called Laffak Garswood, near St. Helens. It was an Arley mine, and we used to fire our shots by the old process at that time, not to fuse nor by electricity, but by what we used to call the German—perhaps Mr. Bainbridge will understand what I am referring to—and there was some error in filling up the German; when I came to light it with my wire it went and I was right in front of it. Of course I remember perfectly the great blaze that there was; it was just like being in a furnace; it blew two tons of coal over my head; it must have taken it over my head; of course I cannot say how it took it; it took my lamp and my cap; it saved my life and did not blind me, though my face was right against the shot. Now that place was completely enveloped with dust, and notwithstanding the fact that there was all the blaze amounting from the shot yet there was not the slightest trace of dust being ignited.

5195. You have seen perhaps, yourself, in some of these explosions, but if not you would have read, that caked coal dust is frequently found after the explosion? —I remember being down two mines. One was the Garswood Park Collieries in an explosion that occurred there. I commenced to work there shortly after the explosion, say within two months after the explosion, as soon as the mine had got opened. I found there, in the very place where the explosion had occurred and where men had been killed to the extent of between 20 and 30 of them, dust thrown all along, in some cases 2 inches thick, in other cases 3 inches, but I never saw the slightest trace of caked or burnt coal dust. It was unconsumed.

5196. Yes, but a negative does not prove anything, does it? That only shows that, if you are correct in this particular case coal dust was not consumed, but it would not answer those cases in which the coal dust has been found in a burnt and consumed condition?—I have read those statements. Of course, I am rather confirmed in this opinion, because I just went through the same experience at the High Brook Collieries. I was the very first to go up the roads after the explosion there. In neither case did I see the slightest trace of burnt coal dust. I should think where there had been a terrific explosion there would have been some traces of this caked coal dust. We have had, in fact, some of the most fierce explosions that have occurred in any county in the country. I should think everybody will agree that the Lancashire explosions have been such. I am rather suspicious, therefore, in my own mind as to whether that is an accurate statement or not. I could not disprove it, but I do not give my adherence to it.

5197. Do you mean that you doubt the evidence as to its existence?—I have never seen it, though I have been in these positions myself; and I think if it had been possible for such to have taken place that I should have seen it either in one colliery or in the other, because in both cases they were dusty mines. I have got the plans of the two mines here, but perhaps you will not require them.

5198. I think not. It is not a question of the plan; it is a question of the fact of the caking?—This was in the Arley mines, and everybody knows the Wigan Arley mines are very dusty mines. That would be before Mr. Hall's inspectorate.

5199. (*Sir William Lewis.*) Mr. Dickinson would be there then?—I think Mr. Higson was the inspector.

5200. (*Mr. Bainbridge.*) It was a long time ago?—Yes, that would be in 1867.

5201. (*Chairman.*) What is your conclusion then on the whole question. Do you believe that all explosions are due to fire-damp?—I do.

5202. Do you think that dust plays any part in the explosion?—Only on very exceptional occasions.

5203. Then under those circumstances do you consider that any further precautions are necessary against dust?—There are two precautions that I think ought to be taken. One is that shot firing ought to be abolished in coal mines. I think that wherever you have coal mines, it does not matter what kind of explosive is used, whether it be gunpowder, roburite, tonite, dynamite, or any other of the patent explosives, you will always be in danger of explosions in coal mines which give off a large quantity of gas.

5204. How would you propose to get the coal in place of using explosives?—Of course a great many of the mines are being got now without—some that were formerly supposed to be impossible to get without explosives. I think the tendency of the age is to drift more in that direction than ever.

5205. What are the substitutes that you think can be employed?—In some places there is the wedge used; of course that is the old method of getting coal. I do not know anything else that could be employed unless some other invention could be adopted.

5206. With our present knowledge do you think that the wedge could be employed universally in coal mines? —I think it could. I think we have coal being got without any kind of explosives in Lancashire to-day—as hard as any seams in the country.

5207. Would that not have the effect of very greatly increasing the cost?—It would increase it, but I do not think very greatly.

5208. Who do you think should pay the increased cost?—That would be a matter for arrangement.

5209. You would not like the men to pay it in a reduction of wages?—Certainly not; their wages are low enough.

5210. But would not that be a probable result. If consumers were for any reason unable to pay the increased cost it would have to come out of somebody's pocket, and is it not probable that it would come in part, at all events, out of the pockets of the men?—I think it would be so infinitesimally small in time that it would not affect anybody seriously, and I certainly think that if it would have a tendency to make our mining safer it ought to be met from the public or from any other source.

5211. To-day another representative of the men has given his opinion in exactly the opposite sense; that is to say, he has said that there must be a certain amount of risk in coal mining?—Certainly.

5212. And that if any attempt were made to get rid of that risk altogether it would destroy the trade, which would be to the injury of the working classes generally? —I do not think that would follow. I might say for your information that when the last Mines Act was being discussed in the House in 1887 the miners of the country had a conference in London here; and, I believe, with the exception of South Wales, that they were all agreed to advise the Government to go in for abolishing shot-firing altogether. The South Wales representatives were the only section of the nation that were opposed to it at that time.

5213. (*Sir William Lewis.*) You are speaking from experience in your own district?—Yes.

5214. Entirely?—Yes.

5215. So that you are not able to appreciate difficulties that might arise in South Wales by the abolition of the use of powder?—Certainly I could not speak for South Wales only by imported knowledge, or knowledge given in conversation.

5216. But from your experience of using the wedge do you think it would be practicable to use a wedge for bringing down a rock top, or for driving through hard measures between seam and seam, or for taking up what is very often found in South Wales under the coal, a rock bottom?—Of course you are speaking now of the metal, not the coal.

5217. Yes, I am talking of the coal?—Of course, in that case, there might be exceptional treatment. I think that even some of the patent explosives, if under proper supervision, and at a proper time, might be carried on with perfect safety.

5218. So that you would qualify it to that extent?—I would.

5219. Where would be the line that you would draw? Would you suggest that as regards the actual getting of coal there should be no explosives, but in any roof that has to be taken down or bottom to be lifted you would allow explosives to be used; is that it?—Yes; or even I would make an exemption if it was found impossible with regard to some mines. For instance, we have mines now where it is supposed to be very

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dangerous, and where the explosives are only used at a time when all the men are out of the shaft, with the exception of the shot firers. That is a common occurrence in Lancashire.

5220. Is that not done generally throughout most districts?—It is not throughout Lancashire.

5221. I mean where safety lamps are used. I am not speaking of open lamp collieries. I am assuming that you would not suggest to abolish powder in open light collieries, would you?—Of course there might be greater freedom there, but my opinion is, and I am confirmed in the opinion, that there is none safe.

5222. Neither open light nor safety lamp?—I mean no mine safe. We had the case of the Hyde explosion; I remember sitting there for three days listening to the evidence, and that colliery had been worked for 50 years.

5223. That is to say, no mine is safe from an irruption of gas?—Certainly, only under very exceptional circumstances. It was stated there in evidence—I have got the report here—that gas had never been seen by anyone in that pit for 50 years; and yet an explosion took place and killed between 20 and 30 people—23 people, I think.

5224. You are still limiting your experience to Lancashire?—Certainly.

5225. Now you said that the extra cost would be infinitesimal?—Yes.

5226. Supposing it was something more than that, would you think it advisable to insist upon abolishing the use of powder, assuming that it would increase the cost of working, by way of illustration, say, sixpence a ton?—I certainly think that cost ought not to stand in the way where human life is at stake.

5227. So that if it meant the shutting up of a colliery you would abolish the use of powder?—I should not think that it would go so far as that.

5228. No, but supposing it went so far as that. I am putting a case that if a colliery could not be carried on without some explosive, would you insist upon abolishing the use of powder to the prohibition of the working of any colliery?—If it was a very dangerous mine, and there was a danger of an explosion I should.

5229. An explosion from gas?—Yes, certainly.

5230. Then you would limit it to collieries where there was a liability to irruption of gas?—Certainly.

5231. Have you any hard rocks in either the top or bottom in your district?—Yes, we have rock roofs and rock floors too.

5232. How do you deal with them?—They are generally got on the old method of working; they generally cut the stret and bring the pillar back, and they never interfere with the roof. They do not do the packing; there is not the same packing there.

5233. Then the question of being hard or otherwise does not affect the point?—Not in those collieries.

5234. No; if they have not got to take it down, the material being hard or soft does not affect the question, does it?—You are now speaking of rock roof.

5235. I am speaking of rock roof where the seams are not sufficiently thick to enable the coal to be extracted without either cutting into the rock roof or taking up the rock bottom?—I do not know that we have any rock roof of that kind. The rock roofs that I know of are where the mines are about a yard thick; we have not anything less than that, and, of course, they work the mine without either touching the floor or the roof.

5236. Then it does not affect the question?—Not in that case.

5237. There you have simply the coal to deal with?—That is so.

5238. And you say the coal can be obtained without the use of powder?—I say they can be; I do not say they are. There are explosives being used in those mines now, but I say that in those cases it would not interfere with the rock roof or the floor, because they get the coal out and leave the roof standing and the floor too. They work it in the yard seam.

5239. Will you assume for a moment that instead of that seam being 3 feet thick it is 2 feet thick, and that in order to get that 2 feet the roof has either to be taken down or the bottom to be taken up, and it is rock: what would you advise under such circumstances?—Of course in those cases the floor would have to come up or the roof would have to come down.

5240. Then if you abolish the use of powder, how would you take that floor up or take the roof down?—My answer to that is that which I gave just now, that it would have to be blown down or taken up at times when there was not so many men in the pit, or they could use one of the supposed safe explosives.

5241. Yes, but have you anything to suggest different to what is the common practice in all coal fields now with respect to setting off shots when there are not many men in the pit?—No, I have not.

5242. Are you acquainted with the provisions of the Mines Act?—Yes.

5243. You have nothing to suggest, then, by way of improvement?—The only thing that I can suggest is that I certainly agree with the inspectors, and they have given utterance to this in their reports for years, most of them, that so long as we have shot firing in our dangerous seams we shall always be liable to explosions. I certainly think that. Then in the other case, suppose that we allow that shots should be fired, then the only recommendations that I should suggest would be that the Mines Act should be carried out, that is, it should be literally carried out; there should be an adequate amount of ventilation, and our managers should see that the safety clauses of the Act are carried out, with a view of preventing accidents.

5244. But are you giving your evidence on the assumption that the Mines Act is not fairly carried out, or that it is carried out?—Of course I hold an opinion of my own that in these days the question of cost is a serious matter. I quite agree with that; it has to be made to pay, both from the employers' point of view and the workmen's, but I believe that there are exceptional cases where the Mines Act is not carried out. I do not say that that applies to the bulk of the collieries. I believe our collieries are far better managed than they used to be, and are managed efficiently; but there are exceptions to the rule in that case. Of course I have had cases come under my own notice where it has been so.

5245. Yes, but may I ask you to assume that the provisions of the Act are fairly carried out; have you, then, anything to suggest?—No, I think they are fairly carried out, but what I mean by that is this: that we think that there is not sufficient inspection, we think that the Act is too loosely carried out in certain ways.

5246. I am asking you, are you giving your evidence on the assumption that the provisions of the Act are not fairly carried out?—Certainly I should say they are.

5247. Now, with reference to your observations after explosions and your difficulty in believing that coke has been found in the nature of small coal charred, which was really what the Chairman put to you; you do not appear to have believed that such a thing could have occurred?—I am rather suspicious in my own mind; I would not like to say it is not so; I could not say it is not so, but I have my own doubts about it.

5248. Did you search for gas when you have gone in after an explosion; or did you search for any other indications as to the direction in which the explosion had gone, assuming that you had discovered where it was initiated?—I searched for gas; of course all colliers do, more particularly after an explosion.

5249. And was it for gas alone that you searched?—No; we were quite conversant with the dust, working in a dusty mine; but I did not notice anything different in the mine immediately after the explosion to what I did on ordinary occasions years after.

5250. But in going along with your lamp what you naturally did was to try for gas as you went along?—Just so.

5251. And you did not observe at all whether some of the timbers or the floor were covered with charred coal dust?—I never saw the slightest indication of it on either the props or the sides or the floor anywhere. The dust looked to me in its regular ordinary condition.

5252. Then you mentioned as to the difference in the gas, and that it was more difficult to observe the gas?—Yes.

5253. It may be more difficult to observe, and as we know, those who are acquainted with the Lancashire collieries, your gas is what is termed quicker?—I should think it is.

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5254. That is to say, it does not show an indication for such a long time before it actually explodes?—But that, of course, only applies to some mines.

5255. In the 9 feet?—In the 9 feet.

5256. I am speaking of the 9 feet at Garswood Hall?—Yes, it applies to that.

5257. But still you do see the gas before it explodes in your lamp?—At the Brynn Hall I was well acquainted with an official there between the two explosions; there were two very soon after one another; and he told me that the mine (and, of course, I have every reason to believe it, because two colliers themselves told me the same thing) was so well ventilated and there was such a volume of air going into the mine that they actually had to work with their clothes on, and yet the gas showing such a peculiar colour as it does in the 9-feet mine, it would naturally escape observation unless it was by a very practised eye, a man that thoroughly understood the nature of the appearance of the gas.

5258. You may have had a large quantity of gas brought down by a fall of roof?—Yes, that has been so in many cases. It was so at Clifton Hall and so at Hyde, I believe.

5259. So that the mere fact of the difficulty of seeing the gas does not appear to me—I say so with great respect—to affect the point that you put to the Chairman?—It affects it in this way: in a low mine the gas is in closer proximity to the eye than it is in a mine about 7 or 8 or 9 feet high. In the latter case it is so much above the man's head that he does not look for it with the same care; it is not brought so intimately under his notice as it is in the low seams such as the yard mine and the 4-feet.

5260. With that knowledge, you say from your experience in examining places after explosions have occurred, that they must have all been due to gas, and could not have been due to either dust alone or gas and dust?—Yes, in most cases that would be so, because most of the men have died from suffocation, not from burns. For instance, that was so at Hyde; there were 23 men killed there; there were very few of them burnt, they were suffocated.

5261. What explosion are you referring to now? What date?—The Hyde explosion. It occurred on the 18th January 1889. I have got the report of it here if you would like to see it.

5262. No, thank you. I want to know the particular date because we have had the Hyde explosion referred to before. Have you had any experience of blown-out shots?—I have. I have had them myself.

5263. What kind of a place was that which you described to the Chairman, where the coal was blown over your head; was it an enclosed place or an open face?—I will shortly describe it. It was in the Arley Mine; it was out of the level; the first shot upbrow cutting through to the level above. We holed the coal at the top up to the roof and blew out both sides. We did not cut any of the side. I had blown one side out and, of course, freed it, and was blowing the other, and it lifted the 2 tons of coal in a solid lump right up—well, over my head it must have been, because it was right behind me. I do not know how it got there; of course, I was too excited. After the explosion I got out as soon as I could. It was just like being in a furnace. I have got the mark on my thumb now where it knocked my thumb, and, of course, all my breast was covered with bits of coal. It was the first shot up the brow, and it threw the coal right into the lower side, the 6-feet place; it was from the higher side into the lower side.

5264. Was there much dust below that?—The place was full of dust; it is naturally a dusty mine.

5265. But the direction of the explosion was towards an open space. There was no concussion?—It was near to the level face, and, of course, there was the 6-feet below.

5266. It was going towards an open space?—Certainly.

5267. But there was no concussion?—Certainly; but it would be more confined than a shot in the level.

5268. It had spent itself by moving these 2 tons of coal, as you have described, just over your head, and possibly altogether not more than a couple of yards?—Certainly about a couple of yards.

5269. And it spent itself in that?—Yes, of course, it naturally spent itself after the shot had blown.

5270. Do you suggest there was any gas there?—There would only be the ordinary Arley gas.

5271. You did not discover that there was any gas before you fired the shot?—I do not think there was. Of course the mine made gas just as all Arley Mines do, but I do not know that there was any sufficient quantity to make us apprehensive of danger.

5272. Is that illustration which you have given the Chairman one of your experiences of a blown-out shot which did not create an explosion but which set fire to the dust and continued for some distance?—That was not a blown-out shot although it blew the coal out. I have had blown-out shots.

5273. But take it that it blew the coal out; in your opinion if dust could create an explosion, you would have had a very different state of things under those particular circumstances, to what you did?—If it had been possible in my opinion for dust to have been, say, a principal factor in an explosion, I will not say the primary cause, but the principal factor, I believe there would have been many scores of explosions in that mine.

5274. I would like you to confine yourself to that particular illustration, because I fail to understand why you should have expected that, even assuming that your theory is correct?—I do not understand you.

5275. You gave an illustration of your being in what you described as an explosion, and you said that if dust would create an explosion you would have had at that particular time a large explosion extending into the workings?—I do not say that I was in an explosion of gas, I only say that I was in the explosion of the shot.

5276. What did you expect with an explosion of a shot in a dusty place; would you have expected that the dust would have been inflamed and have created an explosion which would have continued into the workings?—I should have thought from what I saw of the large flame that was given off by that shot that if it had been possible for dust to have ignited at all it would have ignited on that occasion.

5277. And because it did not, you do not believe that explosions can be initiated by dust?—That is a strong reason that I hold.

5278. (*Mr. Bainbridge.*) You referred just now, in answering Sir William Lewis, to an occurrence which happened at the face of the mine; have you noticed the difference between the quantity and quality of dust in the face of a mine and of the dust in the travelling roads?—I have noticed that frequently.

5279. Have you observed that in the travelling roads it is very much more fine and impalpable?—Yes; that is so.

5280. And therefore more dangerous?—That is so; but I have also noticed that you have a purer kind of dust in the coal face than you have in the road. What I mean by that is, that in the roads, as a rule, you have it mixed with dust from the roof or floor, but it is much finer, because it is constantly being trampled upon. I quite agree with that.

5281. It is very much finer than the coal dust you generally find in the face, which moves forward, as you know, almost day by day, does it not?—Yes.

5282. You would hardly think it right, would you, in that case, when you consider that the coal dust in the face is so much more coarse than the coal dust in the travelling roads, to take an incident which happened at the face to form your judgment upon with regard to coal dust generally?—My inference would be this: As far as I have been able to observe, most explosions have originated at the coal face. I am not saying there are not exceptions to that; I know there are, but most explosions occur in the coal face, and, that being so, if dust would have a tendency to ignite at all, it would be the kind that is lying about the coal face, because the blaze is spent altogether before it gets very far into the travelling roads.

5283. You know there are a good many people who think there have been within the last 10 or 20 years a number of explosions caused by coal dust, do you not?—Yes, I know that.

5284. I know you disagree with that opinion; your evidence is very plain upon that point; but surely you know also that those occurrences of explosions which are said to have been caused by coal dust have hardly happened in the face at all; can you tell me by a single case where the explosion which has been described as happening from coal dust has occurred at the coal face?—I was taking the theory as applying to all explosions.

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5285. I know you are; but I am asking you whether in your knowledge of the explosions which have happened within the last 10 years you can call to mind a single instance of a so-called coal-dust explosion which has happened at the working face?—The Hyde explosion is supposed to have happened at the coal face.

5286. But you say that at Hyde the gas came down from the roof?—Yes, I believe it did come down from the roof.

5287. So that could not have been coal dust?—No, it was gas from the roof.

5288. I ask you whether you know of a single case of a so-called coal-dust explosion which happened in the face?—No; I think Mr. Hall has inferred that a great many of the Lancashire colliery explosions have been brought about either directly or indirectly through coal dust. Now, a great many of those explosions have occurred in the coal face, I believe, either through blown-out shots or a reckless use of gunpowder.

5289. Do you carry one case in your mind; can you mention one case?—I think I can. I think the explosion at the High Brook Colliery on the 23rd of January 1886 is supposed to have fired at the coal face. Then the High Brook Colliery explosion on April 1st, 1869. Then there was the Garswood Park Colliery (in the little Delf) on the 4th of March 1886; and there was also another explosion at the same colliery.

5290. Were these all at the face?—Yes; they are all supposed to have been caused through blown-out shots.

5291. And coal dust?—As a rule there has been coal dust in the mine; of course I am not assuming that it can have happened through coal dust at all. I think the evidence has proved that it is through gas, and the juries' verdicts, after listening to the evidence, are, that these have been purely explosions through gas. Of course I know that the dust theory is a modern one; I am quite aware of that.

5292. I am sure we have your view very clearly expressed, that you do not think that coal dust will initiate an explosion?—I do not think so.

5293. And I think you go a little further than that, and say it is not a very serious thing in carrying it on?—I say this: it would only be in exceptional cases, in my judgment, where it would ignite coal dust. That would more probably be in the road in the case of an explosion taking place, on a travelling road or something of that kind.

5294. But you think an explosion of the gas must take place first?—I do.

5295. And even after an explosion of gas has taken place, it is only in an exceptional case where that explosion can be imparted to coal dust?—I think so.

5296. In that case, would you consider that the provisions of the Mines Act (which are rather important), as regards the coal dust, are unnecessary?—With regard to the watering, do you mean?

5297. Yes?—No; I think it is a great advantage, although of course it has its disadvantages as well as advantages. From the standpoint of preventing explosions, where it can be done, it is a very good provision.

5298. It is a safeguard?—Certainly.

5299. And then there is the sanitary advantage?—Yes, it is better from the sanitary point of view. It is much pleasanter to work where the mine is watered, and I certainly think for this purpose, under any circumstances, and if an explosion might take place, watering would prevent the liability to that.

5300. I should like to ask you a question with regard to the Mines Act not being kept to in your district. I suppose if there had been any violation of the Mines Act, which had come before you as representing the men, we should certainly have heard of it through the Employers' Liability Act, should we not?—Yes; but perhaps I ought to explain what I mean by that. Where there are mines giving off gas, and the employers, after being cautioned by the inspector, still continue to use naked lights, I consider that is a reckless carrying out of the Mines Act. We have had instances of that.

5301. Does not that generally lead to arbitration?—That has been so. My opinion may be wrong, but if there is a danger there is a greater guarantee against explosions where it is watered; that is my opinion.

5302. I regard you as an important witness, representing, as you say, 178,000 men. May I take it from you, that you think there is no variation required in the Mines Act to render explosions less frequent?—Of course I am only speaking so far as dust is concerned. You know we do think there should be an alteration, because we have a Bill before the House now dealing with other aspects of the question. What I think is, that the first general rule should be carried out strictly, and that due precautions should be taken with the explosives, because I do not think we shall ever be safe so long as any explosive is used, for I believe they are all liable to ignite gas. Therefore, what I think is, we have the first general rule saying that there must be an adequate amount of ventilation produced to render gases harmless, and if that is rigidly carried out and sufficient precautions are taken with regard to the shot-firing clauses and the watering, if there is any danger from that, I do not see what other remedy we could suggest.

5303. Then with regard to shot-firing you think that if all the precautions of the present Mines Act are strictly adhered to there would not be a serious danger in carrying on shot-firing?—There would not be so much as there is, I think.

5304. If the Mines Act was strictly adhered to with regard to the shot-firing question?—Yes. Of course, I ought to qualify that by this: We are all very pleased to see the diminution in explosions which has taken place, as a result of mining legislation I believe, and explosions now are of very rare occurrence. Of course, to make mines still more safe, it is very difficult to suggest a further remedy than those already provided. But you will have observed, as well as I, that most of the inspectors give it as their opinion that so long as shot-firing is allowed—and, of course, I speak with considerable experience, having had 20 years in a mine—we shall always be subject to mishaps from some unforeseen circumstance arising. I believe we should be safer if shot-firing were done away with altogether. I believe that naked lights are almost the only causes of explosions.

5305. (*Sir William Lewis.*) That is from a gas point of view?—Yes; of course I do not believe so very much in the other.

5306. (*Mr. Bainbridge.*) May not you carry that rather too far. I am sure we all quite agree that it is very important to reduce the number of explosions and of every sort of accident in a mine; but as to the argument you put forward now, as you know, there are a great many accidents caused by falls of roof?—Yes, certainly.

5307. Now, if there was an Act passed requiring timbers in the mine to be placed twice as close to each other as they are now, that would reduce the falls of roof, would it not?—Yes, and it would reduce something else.

5308. It might reduce the profit?—It might reduce the production.

5309. You can quite see that carrying on the idea of stopping shot-firing altogether might, as we have heard from a witness this morning, be a very serious thing in some districts, though it might not be in yours?—It would to some extent in ours I quite agree, but if it was applied generally I do not think, after it had been in operation like any other reform, that after a time it would be the serious loss which is anticipated. It might be for a time, and in some seams it would come very heavy, in the hard seams, the low seams.

5310. Which do you call the hard seams, where gunpowder seems so important?—The 9-foot is the hardest, the big mines as a rule are the hardest seams to get.

5311. In the case of an explosion like the Seaham explosion, where everybody appears to be agreed that there could not possibly have been any gas at the point where the explosion took place, how do you account for that explosion?—I hold the opinion that there must have been gas. I do not say that gas was seen or known of, but there must have been gas, in my opinion.

5312. You think that those parties who have, after so full an inquiry, come to the conclusion that there was no gas must have been mistaken?—The jury, do you mean.

5313. No; I mean the experts who have made the examination?—The jury did not come to that verdict.

5314. I was not saying a word about the jury. I was asking about the experts who made the examination?—It is just possible that they might err, they are as

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liable to err as any one else. It is a matter of opinion, I suppose. I know the late Mr. Picard held that it was gas.

5315. When you were speaking about the use of a wedge in your district, were you referring to the short wedge or the long wedge—you know there is a wedge about that length (*illustrating*), were you referring to that?—I think I included that by my reference to any other invention which might be suggested. I meant any patent wedge. There are patent wedges now which are used in some mines.

5316. In Lancashire?—I do not think there are in Lancashire, but there are in some other counties—I believe in Yorkshire.

5317. But you know, as a rule, that although a wedge would be by far the best thing to have——?—Yes.

5318. So far it has made very little progress?—Yes, the patent wedge.

5319. Owing probably to the severe manual labour required?—The shot-firing process has rendered it unnecessary almost. It would be more common in the early days of mining than it is now.

5320. I think you spoke just now rather against the idea of high explosives having proved safe, is that so?—Yes.

5321. I suppose it is in Lancashire where roburite has been more used than anywhere?—Yes, but we have an inquiry, now adjourned, on this question where a man is said to have been poisoned through it.

5322. (*Sir William Lewis.*) Poisoned?—Well, the doctor's evidence is to that effect.

5323. (*Mr. Bainbridge.*) Are you now speaking of the after fumes?—Yes. At the time roburite was introduced into Lancashire, that would be about three years ago, there was a big strike for three weeks about it, and I think a member of the Commission was one of the experts called in, who was the public analyst, agreed on by myself on the one side, and the coal proprietor on the other, to inquire into it and bring about a settlement. The report that he made, with the joint medical men, was that it certainly was not fit for anyone to live amongst, the gas was most deadly.

5324. That is so far as the fumes are concerned?—Yes. I was going to say, with regard to the light, that when it was first introduced the Geological Society of Manchester held several meetings, experimenting with it, and they experimented with it in the different collieries. I can produce the "Wigan Observer," giving the results of their experiments, stating that they had seen a glare from it, and I think there have been cases where it has actually ignited gas. Therefore I do not think that any of the explosives are safe. They are safer, considerably safer, perhaps, than powder, but where there is a large body of gas I am afraid we shall always be in danger of an explosion from any of them.

5325. Speaking generally of these higher explosives, you do not go further than to say that whilst you do not consider any of them safe you do think they are, on the whole, safer than gunpowder?—I do; but they are less applicable to do the work.

5326. (*Sir William Lewis.*) I think you said that you represented 178,000 workmen?—I am the vice-president of an association which has that number.

5327. In the views you have expressed here is the Commission to take it that you represent the 178,000 workmen?—What I say on that point is this, that of course I could not put that before 178,000 men, but from my general knowledge only of opinions expressed in conference, in public meetings, and in other places, over 90 per cent. of the men would hold the opinion that dust could not originate an explosion.

5328. But this question has never been submitted as a question for the men to give an expression of opinion upon?—Only by way of resolutions at public meetings.

The witness withdrew.

Adjourned to Friday 4th March next, at 12 o'clock.

At 23, Great George Street, Westminster.

FOURTEENTH DAY.

Friday, March 4, 1892.

PRESENT:

THE RIGHT HON. JOSEPH CHAMBERLAIN, M.P., CHAIRMAN.

LORD RAYLEIGH.	MR. CHARLES FENWICK, M.P.
SIR WILLIAM LEWIS.	MR. EMERSON BAINBRIDGE.

MR. J. WILSON, *Secretary.*

MR. HENRY WILLIAM MARTIN called and examined.

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5329. (*Chairman.*) You are a mining engineer?—I am.

5330. Vice-president of the South Wales Institute of Engineers?—I am.

5331. And a member of the Monmouthshire South Wales Coal Association, and general manager for the Dowlais Iron Company's collieries of South Wales?—I am.

5332. What was the output last year?—1,034,775 tons.

5333. You have had a large experience in the management of collieries and ironstone mines?—I have had over 30 years.

5334. In what districts?—In the Aberdare district and the Merthyr district; also in the Durham district, and in Japan.

5335. What is the class of coals which are worked in the Dowlais collieries?—Steam coals and bituminous coals.

5336. Are the mines what are called dusty mines?—They are not.

5337. How are they worked, what safety lamps are used?—The Evan Thomas' Bonnetted Clanny in some collieries; in other collieries we work with naked lights.

5338. Is shot-firing employed?—Very largely.

5339. Can you state what is the average number of shots fired?—We fire upon an average 383 to 400 shots a day.

5340. Are these mines subject to fire-damp?—Yes, all except the bituminous collieries; in the bituminous

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collieries we have not had any gas, we have never seen any gas in them.

5341. When you say that naked lights are used, do you mean that those are used in collieries in which there is fire-damp ?—Yes.

5342. Is that in the steam coal collieries ?—In the steam coal collieries.

5343. Have any explosions occurred in those collieries ?—Yes, several—slight ones.

5344. Have any explosions occurred in the bituminous collieries ?—None whatever.

5345. And your observation as to the mines not being dusty applies to both classes of mines ?—Yes.

5346. Now, has your attention been directed to the question of the importance of coal dust as an agent in causing explosions ?—It has.

5347. What is your view as to the danger of coal dust in mines ?—I think that coal dust aggravates explosions initiated by explosions of fire-damp.

5348. That is to say that when any explosion has been initiated by fire-damp you think that coal dust may increase its danger and extend it ?—Undoubtedly.

5349. Do you think that the presence of coal dust makes an explosion of fire-damp more probable; does it increase the liability to explosion ?—Yes.

5350. Do you think that coal dust alone in the absence of fire-damp would cause an explosion ?—No, not as we see it in the general working of collieries. Under the ordinary conditions of working a mine I do not think that it would.

5351. What is the method of working the thin seams of coal in South Wales ?—By long wall, but there is a great deal of roof ripping and bottom cutting.

5352. Does that produce much dust ?—Yes, shale dust, stone dust.

5353. What is the effect then of the production of that class of dust in those mines ?—I think that it renders the coal dust less liable to burn or inflame.

5354. Does that account in your opinion for the non-liability to explosion from dust in Welsh mines ?—Partly, but I consider the damping of the dust to be the chief means of preventing the extension of explosions.

5355. I suppose that the quality of the coal dust differs in different mines ?—I believe so.

5356. And that some might be expected to be more explosive than others ?—More inflammable than others.

5357. Have there been any experiments in your experience which show this ?—I took great interest in the experiments made by Mr. Galloway some years ago, about 1885 and 1886 I think. He made some experiments at Dowlais and I took great interest in watching those.

5358. What was the effect of his experiments ?—They have been reported; but what struck me regarding the difference in the dust was, that when he had not dust in those experiments obtained from collieries in the Rhondda Valley the experiments were delayed; the dusts supplied to him from collieries in the neighbourhood were not suitable for his experiments.

5359. They failed to explode ?—So far as I could see they failed to explode, and in fact he would not use them. The dust he obtained from other collieries was the very finest, and it was specially dried, and then fanned up with a mixture of gas.

5360. In those cases, and under those circumstances, which you consider exceptional, he secured explosions ?—Yes.

5361. Now, do you consider that the colliery explosions of which you have any knowledge have been caused by fire-damp alone ?—I do.

5362. What explosion would you give as an illustration of that ?—My chief experience is with fire-damp explosions; but I saw a mine after an explosion in the Pochin pit at Tredegar.

5363. What were the circumstances of that explosion ?—At the inquiry they did not come to any full settlement how it originated. The inspectors of mines did not agree with the evidence given by the experts, and the manager of the mine did not give any opinion at all. But I think that the explosion was initiated by fire-damp alone, and was aggravated and extended by dust.

5364. I take it, then, that in your opinion, coal dust is only to be considered as extending an explosion ?—That is so.

5365. And according to your own experience, and in the mines with which you are at present connected, you do not think there is even that danger ?—In some places where you have a very dry place, of course, it would aggravate an explosion.

5366. But you tell us that the dust in the mines with which you are most familiar is mixed with shale and stone dust ?—That is so.

5367. And is thus rendered innocuous ?—Yes, more or less.

5368. Under those circumstances do you consider it necessary to take any precautions against dust in such mines ?—Yes.

5369. Why ?—Because I would not trust dust at all under any conditions without damping it.

5370. Therefore, although in your experience you have no knowledge of any danger caused by coal dust, you think that there is a danger which ought to be provided against ?—I do.

5371. Now, will you tell the Commission what precautions you think ought to be taken ?—I think that the dust should, as far as possible, be removed from the main roads, and that damping should be carried on in addition.

5372. Where should the damping be carried on ?—In the main roads.

5373. Only in the main roads ?—Yes, I think the greatest danger is to be met with in the main roads from dust.

5374. Would you make any attempt to damp down at the face ?—I do so in one instance, as shown on plan. I do not think it is absolutely necessary to extend it further.

5375. Would you explain to the Commission what your system is ?—I have some tables of hygrometric readings taken of our system of damping dust by compressed air and water, and also photographs of the spray. I am not a photographer, and I have brought the best I could. *That* is a photograph of the spray of compressed air and water (*producing photograph*). It shows how light it is, and that it is carried into all parts of the mine behind the timbers. *That* is another, and *that* is another (*producing further photographs*). It is so very light that it travels with the air current.

5376. (*Lord Rayleigh.*) Is the air used under high pressure in the hoses ?—The compressed air is about 45 lbs. per square inch.

5377. (*Chairman.*) Now, is this spray created in different parts of the mine ?—Yes, it is created in different parts of the mine. I have a small plan of the mine (*producing plan and explaining same*). The air goes down this south pit, the down-cast, which is 334 yards deep, and it travels down the main drift. *This* is the line of faces. The air travels *here*, goes along to the face, up the working face, and back through the returns to the up-cast shaft.

5378. It follows in all respects the course of the ventilation ?—That is so. In this case the pipes for carrying the compressed air were first laid for pumping at the bottom of the drift. We use the same pipes for pumping and for supplying the compressed air for the sprays. Then, we lay pipes from springs in the pits, and get whatever pressure of water is necessary, generally about 90 lbs. to the square inch, so that, if the air compressor stops for any reason, we are able to produce a fine spray with water alone under a pressure of 90 lbs., which is increased as the workings extend by the extra depth, the drift dipping about 3 inches to the yard.

5379. How do you get the pressure on the water ?—The pressure on the water is got from the height of the spring in the pit.

5380. What is the position of the sprays in the course which you have just shown us on the plan ?—I have had them numbered Nos. 1, 2, 3, and so on, right up to 23. No. 23 spray is absolutely in the colliers' face where they are working a long wall face. I should perhaps explain, too, that Nos. 27, 28, 29, and others, are in the main return, and damp the dust in the main return wherever we choose to take it. We take it into the return at every level, say every 300 yards, and so damp the dust in the intake and the returns.

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5381. What is the average distance between the different sprays?—Here is a table of hygrometrical readings that I have had taken. No. 1 spray is 161 yards from the pit, the next 264, 374, 560, and so on—at varying distances. My evidence in this matter is borne out by Mr. Galloway, who has seen these sprays. He thinks that one in 200 yards would do all that, but I have them from 50 to 60, 70, and 80 yards right through.

5382. You think that one in 200 yards would sufficiently damp the dust?—Yes; but there is very little saving in reducing the distance, because if you have them in every 100 yards you need not work them together, you can work them alternately. The difference between the wet bulb and the dry bulb is about two degrees—54 and 52. Then at 60 yards beyond the spray you get perfect saturation, and another at 63 yards, and another at 44, always keeping the temperature down and getting perfect saturation at those distances. It takes a very long time to get a large number of readings if you want to get the maximum distance. I have not taken the maximum distance here. It depends greatly, too, upon the velocity of the air in the mine, the distance which you can convey the moisture. In No. 2 Bedlinog Pit, a very deep pit, and which is more dry and dusty, except in places where we have water breaking down from a seam above, we have a very high velocity, and the greatest distance that we can get perfect saturation with water alone under pressure is something like 18 yards; that is with a velocity of air travelling at 1,000 feet per minute. Here we can get it 70 yards, and the velocity only from 250 to 300 or 400 feet.

5383. I understand then that in the deep pit in which the saturation is only carried 18 yards the difference is due to the fact that in that pit you have not got compressed air?—That is so.

5384. And that in order to carry the saturation a considerable distance it is desirable that the water, even although it is at high pressure itself, should be accompanied by compressed air at high pressure also?—That is so. Only you do not require the water at the high pressure with compressed air, except that should the compressing engine fail you can produce a spray independent of the air compressor equal to what you can produce with ordinary sprays under water pressure alone.

5385. But the most efficient result is attained when you have the compressed air?—Undoubtedly. That is the system that Mr. Atkinson, one of Her Majesty's inspectors of mines, wrote you upon, and of which he said, I think, that it is certain that under that system no explosion from dust could possibly occur.

5386. Now what is the effect of this saturation upon the dust in the main roads?—It absolutely damps it.

5387. Is it damp to the bottom, because we have been told that in ordinary damping only the surface of the dust is damped, and that the water remains on the surface while underneath it is as dry as ever?—This damps it thoroughly. Of course if a mine is left to accumulate so much dust that you cannot damp it, then the simplest method is to remove the dust. A river will not damp some places, if they allow the dust to accumulate.

5388. You do not think in any system it would be safe to dispense with the occasional removal of the dust?—Certainly not; the more they remove the dust the less water they will require for damping, and the healthier the mine and the safer in every respect.

5389. And by your system do you find that the dust which remains, which must always be a thin coating if you are constantly removing it, is saturated?—I do. The fine and dangerous dust that I think lurks in the sides and roof and behind the timbers—that very fine dust that the gentleman who made the experiments with dust endeavoured to obtain by fine brushes, is absolutely damped and rendered, I think, harmless.

5390. Have you any other plans to show us?—*This (producing another plan)* is a detailed plan and section showing how this spray is worked. The compressed air is taken in one pipe and water is taken in another. They are brought together, and there is a nozzle *here* through which the air goes; the water flows up the other and it simply forces fine spray, absolutely as fine as steam, and which you can see after the tables are read at the hygrometer travelling on the air.

5391. (*Sir William Lewis.*) In each case in the direction of the current?—Yes, that is so.

5392. (*Lord Rayleigh.*) Is this nozzle attached at the end?—Yes, that is attached at the end.

5393. We understand that these sprays are at work day and night?—No, we work them whenever it is necessary, very often at night and not in the day.

5994. For a limited number of hours?—Yes.

5395. (*Chairman.*) I gather that by this scheme the spray permeates everywhere?—It does.

5396. And will go into corners, and on to the roof and the timbers, and every part of the mine is saturated?—Yes, wherever the air travels.

5397. Does the system incidentally improve the ventilation and temperature of the mine?—It does.

5398. Now, in how many of your collieries is the system at work?—Three.

5399. And for how long has it been at work?—Since about 1886.

5400. (*Sir William Lewis.*) That was the first?—Yes. That was before we went in for it largely. The experiments started in 1886.

5401. (*Chairman.*) To what extent has this system been carried out in any particular mine?—At the South Tunnel pit it has been carried out very largely; the plan of which I have handed to your secretary.

5402. What is the total length to which the system is carried in that mine?—I believe we have over 3,000 yards laid there now.

5403. And you consider that where this system is adopted, an explosion from coal dust would be impossible?—I do.

5404. Is that also the opinion of the mining inspectors who have seen it?—It is the opinion of Mr. Atkinson, taken from his letter to you, and it is the opinion of Mr. Galloway.

5405. Can you tell us whether this system has been adopted by any other mine owners?—Yes, it is adopted by the Plymouth Iron Company's collieries.

5406. Where are those collieries?—In the Merthyr Valley. It is also employed in part of the Powell Deeffryn Company's collieries in the Aberdare valleys. I have sent some sprays up to Lancashire to some of the mining inspectors. I think Mr. Makepeace had some to try.

5407. Is the process a patented one?—It is.

5408. Is it expensive to apply?—No; it is not a matter that I have pushed at all in any possible way, but it produces a spray certainly far superior to anything I have seen.

5409. Would the expense of applying this system to a mine be considerable?—Where they already have compressed air working, it would be simply the laying of the pipes.

5410. And compressed air is frequently used in the mines for the purpose of working the mines?—Very frequently.

5411. Now do you think that any additional precaution ought to be taken with regard to lights?—No, not with regard to lights.

5412. Is there no danger in your opinion in the employment of naked lights in these collieries in which fire-damp is known to exist?—I think the danger from explosions, due to the using of naked lights in a colliery, such as we have at Dowlais, is not so great as the danger due to accidents from falls of roof. The danger to the workmen using a naked light from the risk of explosions of gas, is not so great as the risk of falls of roof due to the want of a better light.

5413. (*Lord Rayleigh.*) I understand you to mean by your last answer, that more would be lost than would be gained by the adoption of a safer light, which would entail a less degree of illuminosity?—That is so.

5414. As to the use of spray, can you say whether there is any serious objection to the use of spray?—None whatever, I think.

5415. I think some witnesses have suggested to us that there would be difficulty from the breaking up of the floor in certain cases?—That is where you overdamp the floor. If you make the floor thoroughly wet, which a large number of the water sprays only do, you may get an upheaval, and do get upheavals; wet floors, where you have a heavy squeeze, make the bottom rise.

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5416. But you think all that is necessary to be done for the purpose of damping the dust can be carried out without entailing that risk?—That is so.

5417. (*Mr. Bainbridge.*) Which coal seams are you working in those mines?—We are working all the known steam coals in the Merthyr and Aberdare Valleys.

5418. And which do you consider the most dusty to a dangerous degree?—I think the most dusty is the nine feet.

5419. And which do you consider the most fiery?—There is not much to choose from. It much depends on the kind of roof you have, and the position of other seams above or below.

5420. What lights are you working with?—We are working a bonnetted Clanny in some collieries, and we are working with naked lights in other collieries. Out of the total quantity that we raised last year, we used safety lamps for about one-third of the quantity, and naked lights for two-thirds.

5421. Are you working naked lights anywhere where you are having these precautions against dust?—Yes.

5422. You are taking the precautions against dust, then, in some mines that you are working with naked lights?—Yes.

5423. Are these precautions for sanitary reasons or for danger?—For danger.

5424. Then you are using naked lights now in mines where you consider dust is dangerous?—No, not where I consider dust is dangerous.

5425. Might be dangerous?—I perhaps go further than a great many people in damping. I think it is better for the colliers to work in; they are very pleased with it. The mine is far more pleasant to work in as well; and not only that, but I am doing it with a view of extending that system of damping throughout every colliery we have.

5426. But keeping to the mines that are worked with naked lights, I take it that those are the mines that are not free from gas? — Yes, but we shoot there largely.

5427. But they are quite free from gas?—Oh, dear, no.

5428. They have gas in them?—Yes.

5429. Then they are worked by the long-wall system, I suppose?—That is so. If you will pardon me explaining, we have a large number of collieries that have been working for many years, and have been worked from the crop down to a great depth without any break. These mines are absolutely more or less damp, and free from dust; but from the crop down they have all made more or less gas, and during the many years that they have been worked we have had large numbers, speaking now from the old days, of small gas explosions—no serious ones. But in our wider and deeper collieries, the Bedlinog Colliery for instance, they are about 600 yards deep; they are divided by faults and pillars of coal, large pillars of coal, from the other collieries. In this colliery we have, within the last couple of years, had five very serious outbursts of gas. There we work entirely with safety lamps.

5430. (*Sir William Lewis.*) That is Bedlinog?—Yes.

5431. (*Mr. Bainbridge.*) Coming back to the places where you are working with naked lights, I only want to understand whether you use the spray there for sanitary reasons or to provide against danger?—To provide against danger.

5432. As well?—Yes, as well as for sanitary purposes.

5433. Then you think, if you did not provide the damping arrangements, you would run the risk, as you are firing shots occasionally, of having an explosion of coal dust alone?—No, I do not think so. I do not think we would there.

5434. Why do you damp the dust, then?—Simply because I believe that it is a thing that will have to be done everywhere. I think it is a proper thing to do.

5435. Because of the danger, do you mean?—I do not wait until we get serious danger.

5436. You said you were providing against danger; what was the danger that you were providing against?—I think that there is always more or less danger underground.

5437. Then it would be the possible risk of an explosion which would be there if you did not damp the dust?—That may be so. Yes.

5438. In that particular case do you use explosives on a large scale?—A very large scale.

5439. What explosives do you use?—We have been using dynamite and powder chiefly. We are now using roburite as well; we use the three.

5440. Is there anything you would like to tell the Commission with regard to your experience in explosives?—I am sinking two very deep pits at Aberdare Junction at the present moment for the Dowlais Company, and lately I had a serious accident with the man who prepared the shots. He used to warm the water in a small kettle, which was kept for the purpose in the sinker's cabin, and poured the water into the bath, the ordinary dynamite pan. One day he did not go for fresh water, but he emptied the water from the inside of the bath into the tin kettle. He took that water and put it on to the fire, and he very soon had a very serious explosion, which killed him and burnt a boy very seriously. I think this was caused by the nitro-glycerine exuding from the dynamite cartridges, and when he poured the water from the pan into the kettle probably a very little nitro-glycerine went in with it, which was quite sufficient to do the damage. I have abandoned the use of dynamite altogether, and I have taken to gelignite instead.

5441. That is for sinking shafts?—Yes, and for blasting top underground. I have given up the use of dynamite altogether.

5442. In using gelignite, do you use it in conjunction with water or by itself?—By itself.

5443. Do you find it flameless?—No. I do not know that any of them are flameless.

5444. Do you find roburite flameless?—It shows less flame, I believe, than the others, but I very much doubt myself whether any of them are flameless.

5445. Would you regard it as a very serious thing to have explosives entirely done away with in your mines?—Most serious.

5446. And with that in view, you are aiming, I suppose, at trying to find an explosive that is less inflammable than gunpowder?—We endeavour to do all we possibly can to minimise danger from shot-firing.

5447. Do you think you have not succeeded in finding a flameless explosive yet?—I do not think so.

5448. With regard to watering, the Chairman asked you about the expense; can you give us an idea of what the cost would be in that case where you have 3,000 yards of pipes?—I cannot give you the cost now. Of course it is simply a matter of so much per yard of piping and fittings; that is absolutely what it has cost us.

5449. Would it cost 1,000*l.* for a mine of that kind?—No, nothing like it.

5450. I see you seem to have, at every point where you bring the air and the water together, two brass valves?—That is really a very small item. As I have said before, I have not pushed this matter, and I can hardly tell you the cost of these little things, but it is a very small item in the management of a colliery.

5451. I was not referring so much to your particular process as to watering generally, where watering is done thoroughly, whether the first cost becomes an important item?—Yes, undoubtedly; everything in these days adds to the cost.

5452. Can you tell us in the case where you have the water taken down at a pressure of 90 lbs. due to the head of water, what is the pressure of air you have?—45 lbs.; that is the pressure of air that we used for working or hauling engines and pumps.

5453. Then, in mixing together the air and the water at relative pressures of 45 lbs. and 90, I suppose the mixture is entirely regulated by the position of the nozzles?—Yes, and there is a tap to each pipe, one regulating the water and the other regulating the compressed air.

5454. And your men, by degrees, get accustomed to the exact position of these nozzles, so as to give the right degree of saturation?—Yes, quite so.

5455. Are your mines at all subject to upheaval of the roads?—Yes.

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5456. Then do you not run some risk in a large mine of having the pipes broken by upheaval with a high pressure of water; in case of their being broken, would not the water flood the mine?—Oh, dear no, the amount of water would not affect it in that way.

5457. What size of water pipe do you use?—Beginning, say, at 2 inches; of course, the size of the water pipes and the quantity of water that you would use depend upon the extent of the mine, the number of the sprays, and the quantity of the dust.

5458. Your experience is that there is no difficulty, as a rule, with regard to accidents to the pipes themselves?—No, none whatever. That is a very small matter, a less matter than if you are pumping at a dip, and the pipe broke for a few moments.

5459. Lord Rayleigh asked you with regard to the time those sprays were at work; can you tell us what proportion of the total working hours, or the total 24 hours, your sprays are working, roughly speaking?—I think if you work these sprays for an hour of an evening, it would be ample, and work them alternately, so that you would not make it a burden upon the compressor.

5460. Each spray working about an hour per day?—Yes; and of course that again depends upon the state of your mine. I could not answer for what it would require for a mine like some of them in the north, where it is said they are so very thick with dust.

5461. Are your mines worked by fan or by furnace?—We have some by furnace, some by fan.

5462. Do you find that the cooling of the return air current by this process at all checks the ventilation?—What it does is this: when you have 14 sprays running at the same time, I find, taking the water gauge at the separation doors at the bottom of the pit, that it increases the water gauge about one-tenth.

5463. Then you get the ventilation somewhat impeded?—You benefit it by cooling and by damping, but you add to the water gauge due to the velocity of the air.

5464. Do you find no change in the volume of air?—Of course the volume of air would change in proportion to what the water gauge shows.

5465. Have you ever measured to see?—It would be very light. It is too small a matter, I think, to affect us at all.

5466. The volume of water perhaps you cannot tell us, can you?—We use about from three to four gallons per hour per spray.

5467. On the average?—On the average we make the spray so fine that if you pass your hand close to the spray it simply just wets it.

5468. You mentioned that you had recourse to the removal of the dust as well as damping?—Certainly.

5469. If you damp it as well as your process does what dust is there left to remove?—You will get it into mud if you extended it sufficiently far.

5470. I mean dry dust, what dry dust have you got to remove in your mine?—None, where you absolutely damp. But I have not even extended it throughout the whole mine. I am extending these sprays in the main ways chiefly with a view that if an explosion occurred my main ways would be saved, and we would be able to give relief and succour to those perhaps who were left in the faces of the mine.

5471. With regard to safety lamps, have you succeeded in finding any lamp which gives you such an improved light as to reduce the accidents that you refer to by falls of roofs?—I have tried electric lights; I have tried that lamp that gives the best light.

5472. The long heavy lamp?—Yes.

5473. (*Sir William Lewis.*) At all events a recent lamp?—It is a new lamp.

5474. With a compound name?—Yes.

5475. It is a very heavy lamp, and it gets hot?—It does get hot, but I think a great deal of that is due to the want of care in starting to use it.

5476. (*Mr. Bainbridge.*) Are you yourself a believer in the idea that an explosion can take place from coal dust alone, without fire-damp?—No, I do not think that coal dust alone without fire-damp will initiate an explosion.

5477. (*Sir William Lewis.*) Do you find any difficulty in your district in getting the workmen to make the examination which they are entitled to make under the 39th General Rule of the Mines Inspection Act?—Whenever they like to go they go, but our colliers are satisfied not to go. There is more difficulty in getting them to give up the time than anything else.

5478. You can only speak as to experience at your own collieries?—That is all.

5479. You referred to experiments made at Dowlais by Mr. Galloway, in answering a question from the Chairman, those experiments were tamping with coal dust?—That was so, and with the dust placed upon shelves and fanned up in a box.

5480. Were they not for the purpose of ascertaining whether there was a flame with blown-out shots?—That was so.

5481. Will you tell us what was the result of the experiments of Mr. Galloway and yourself; I know you took a very prominent part in them?—They ignited dust.

5482. That is the flame from a blown-out shot ignited dust?—Yes.

5483. Have you ever had a similar experience underground where a blown-out shot has ignited the dust?—Never.

5484. You do not know of any such thing within your experience?—No, never.

5485. Do you think it is possible for a blown-out shot to inflame the dust in a confined space underground?—Without gas?

5486. Yes?—No.

5487. Not to inflame it?—No. If you have a blown-out shot of powder, so long as the sparks from the powder are travelling with great force through fine dust they may inflame it, but simply close to the sparks of powder.

5488. Do you, or do you not, think it is possible that a blown-out shot may create an explosion without gas?—Certainly not, that is under the conditions that we see the dust in a mine.

5489. Assuming, if you like, that the manager neglects to remove the dust in the neighbourhood of a place where a shot is going to be fired and that that shot is unfortunately a blown-out shot, can you believe that that shot may create an explosion although there is no gas there?—I do not think it would, but I would prohibit firing two shots in the same place at the same time.

5490. For what reason?—For the reason that you may have two blown-out shots; one will raise the dust and the other may fire the gas; then under the conditions under which I read, gas has been fired by Mr. Hall in his pit.

5491. Assume there is no gas there?—I am still assuming that; I do not believe that it would occur, but you would get so near the actual experiment carried out by Mr. Hall, that to avoid this probable danger I would prohibit the firing of more than one shot underground at the same place and at the same time.

5492. But you have heard of accidents where it has been suggested that one blown-out shot raised the dust and the shot immediately following it created an explosion, or what you would perhaps describe as an inflammation?—I have heard so.

5493. And your object in preventing two shots being fired almost simultaneously would be to prevent the risk of such an inflammation?—That is so.

5494. But you do not think that could possibly create an explosion?—No, I do not think so.

5495. Now with respect to the provisions of the Mines Act for clearing dust and examining the place before shots are fired; have you anything to suggest to the Commission as to any improvements that your experience would recommend in that direction?—No. I think that it is absolutely necessary that dry dust should not be allowed to accumulate, and that in all cases the main roads should be watered, damped, to what extent I would hardly say, but to a large extent.

5496. Then you said that you had recently adopted gelignite?—Yes.

5497. Have you had any complaints from the workmen as to the fumes after putting off shots with

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gelignite ?—None so far. It is only recently that I have adopted gelignite.

5498. Have you tried it in enclosed spaces such as narrow headings ?—In a few.

5499. Have the men complained or not ?—Not yet. I may tell you that it is only recently that we have begun to use roburite.

5500. Have you followed closely the results of the experiments both in Wales and in Chesterfield, as well as in the north, with respect to obtaining explosions from coal dust ?—I have. I have read several accounts of the inquiries.

5501. And with your knowledge and experience you have come to the conclusion that it is impossible to initiate an explosion with coal dust alone ?—With coal dust under the ordinary conditions of working a mine.

5502. Would you consider that there would be any advantage in further experiments in the same direction on a larger scale ?—For myself, I am perfectly satisfied without any further experiments. I believe there are some people who would still desire further proof.

5503. You have little doubt yourself ?—I have no doubt whatever.

5504. And there is no need of any further experiments so far as you are concerned ?—Not a bit.

5505. (*Mr. Fenwick.*) Do you carry your practice of damping to the working face ?—We have, in this instance of the one pit that I have given you the plan of.

5506. Only in this one instance ?—Only in this one instance.

5507. Generally, you confine the damping to the main roads ?—Yes, and the most dusty parts of the main roads.

5508. Do you suggest that the damping process should be carried into every division of the main roads ?—I do, that is where it is dry and dusty.

5509. What course do you adopt in removing the dust; do you brush it ?—No, we fill it into trams, into tubs.

5510. In that case will not you only get the heaviest particles of the dust ?—But our mines are really not dry and dusty in the sense that you have had some evidence from the collieries in the north, and from some of the collieries in South Wales too.

5511. Then you do not think that it is necessary to adopt the system of brushing, do you, to remove the dust ?—Not if you damp.

5512. Has your experience in South Wales been confined to mines principally in the steam coal district ?—Steam coal and bituminous coal.

5513. I think you said that in the steam collieries you had had experience of explosions, but they were very slight ?—That is so.

5514. At what collieries were they ?—At all our collieries; we have some 10 or 12, and we have had explosions in all.

5515. Were there any lives lost ?—Sometimes a few; one, two, three.

5516. Not more than that ?—No, I do not remember any more.

5517. Principally, I think you said that you work your low seams on the principle of the long wall ?—We work all long wall, nothing else, excepting in the bituminous coal.

5518. On a square face or otherwise ?—Sometimes one way and sometimes another, but as a rule we keep all our faces square, without cuts.

5519. And you do not damp in those places ?—No.

5520. Do you fire shots ?—Where we fire shots we damp.

5521. Have you any gas in those places ?—Yes. Are you speaking of naked light collieries, or of safety lamp collieries at the present moment ?

5522. My question would apply to both cases ?—Where we fire shots out of the reach of the watering by piping, then we water by casks; take casks of water and sprinkle it about the ground.

5523. Where you have the presence of fire-damp, do you think that it is safe to fire shots under any conditions ?—Yes.

5524. Have you ever had explosions even with damping, where you had the presence of fire-damp ?—I do not know of one explosion we have had by firing shots into gas.

5525. Is the practice of damping, as provided by the Mines Act of 1887, pretty generally observed in South Wales, in your opinion ?—Yes, I think it is.

5526. (*Mr. Bainbridge.*) I suppose you have read the accounts of most of the explosions which by some people are attributable to coal dust ?—Yes.

5527. Have you in your mind such explosions as Seaham and Altofts ?—Yes, I know Altofts.

5528. And Elemore ?—Altofts more particularly.

5529. Altofts being a place where an explosion took place when a shot was fired, and where, as far as could possibly be judged, there was no gas anywhere near the place, can you give us your own idea how that explosion could have taken place ?—Not if there was no gas. If I remember aright, they fired three shots; two together, and then one afterwards.

5530. And there was a very violent explosion indeed ?—Yes.

5531. Extending for more than a mile ?—Yes, I have seen the plan and I have read the evidence given before you.

5532. I mean with the view you hold as to coal dust not being able by itself to cause a big explosion, do you assume that there must be some mistake there with regard to the statement that there was no fire-damp in the pits ?—Yes, it is evidently a mine that makes a lot of gas, that was shown by the fires afterwards.

5533. Yes, at the face, but this was a long way from the face ?—The fact that they had an explosion which they attribute to shots fired into dust alone is my chief reason for suggesting to you, gentlemen, that I would add to the general rule a clause prohibiting the firing of more than one shot at a time in the same place.

5534. But from your own point of view you do not think that explosion could have taken place in coal dust alone, is that so ?—I think it could not.

The witness withdrew.

Mr. George William Wilkinson called and examined.

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5535. (*Chairman.*) You are, I think, general manager of the Risca Colliery and the Abercarn Colliery in Monmouthshire, and the National Colliery and North Dunraven Colliery in the Rhondda Valley, Glamorganshire ?—Yes.

5536. What is the character of these mines ?—They are very dry and dusty and gaseous.

5537. Have you had any experience of an explosion at any of them ?—I have at Risca.

5538. When did it take place ?—In 1882, on the 15th of January.

5539. What was the cause of it ?—In my mind undoubtedly a blown-out shot in the main intake.

5540. Did coal dust play any part in that explosion ?—It did.

5541. Will you give the Commission the details of it ?—I think I could more easily explain it to you if you had this plan in front of you (*producing and explaining plan*). *This* represents the downcast, *this* the upcast, and the main intake is *here*. There were four shots fired and a fifth which had not been fired. I may mention generally that it was under exceptional circumstances; all the men were removed, and there was no one in the colliery except the officials and one man who had drilled the holes. The shots were *here* in a current of air of about 60,000 cubic feet. The first shot was fired at *this* point, and it had evidently done its work; then they fired a shot *here* (represented by a section in the top), and then the men retired and fired two of these holes and it got to *this* point, when evidently a very violent explosion occurred. My opinion is that this was caused by the second shot, which had hung fire, firing right across the road, as it were, or rather in *this* direction. The concussion from the third and fourth shots had evidently started the dust, and as the dust passing from these shots had come opposite this

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place, the second shot fired into it and caused a most violent explosion. Everything points to that.

5542. Was there any presence of gas?—None whatever. *These* are solid pillars of coal in every direction. It is a very hard rock roof, and the holes are in existence to this day after a lapse of 10 years. The explosion went to bank, blew the top of the fan off, tore the iron trams in *this* direction like shreds of paper, killed 60 horses *here*, and the four men, three officials and the shot-firer. There were few or no marks of burning upon any one of them.

5543. The mine is, however, a fiery mine?—It is a very fiery mine, but this was in the main intake within 200 or 300 yards of the bottom of the pit.

5544. And your reason for supposing that there was no gas there at the time was the extent of the ventilation?—The extent of the ventilation, and the fact of this roadway practically being a stone drift. The coal was some 3 or 4 feet below the roadway, the top had been constantly ripped, and it was solid rock on either side.

5545. If your theory is correct, the third and fourth shots raised a cloud of dust which was carried to where the second shot was hanging fire, then the second shot gave out?—That is so.

5546. And then the explosion took place?—Yes. Everything goes to confirm that.

5547. What was the result of the inquiry which was held into the explosion?—Accidental death, but I think there was no reason given except "from shot-firing."

5548. No allusion was made in the verdict to the presence of dust?—No, there was no allusion to that.

5549. Then from your experience, and especially from your knowledge of what took place in this explosion, you think that the presence of coal dust is a serious danger?—A very serious danger.

5550. And that it may even be the cause of an explosion without fire-damp?—Undoubtedly, in my mind.

5551. What precautions do you think it necessary to take against this danger?—To thoroughly water the ways; in fact, to saturate the atmosphere.

5552. Are you acquainted with the process which has been described to us by Mr. Martin?—I am.

5553. Do you approve of that?—I do where it is practicable. The spray system that we use is merely the pressure of water without any air.

5554. You do not use compressed air in your collieries?—I have not hitherto. At several of our collieries we have no compressed air. I think that this is such an important point, and that the saturation is so absolutely necessary to the safety of the mine, that it might and could be automatically maintained. This is a theory that has merely presented itself to me, but I think it is worth consideration that a thermometer could be so constructed that when the air becomes saturated to the dew point, the taps could be regulated by means of some electrical arrangement which could be worked by the wet and dry bulb thermometer.

5555. So that the saturating spray you mean would be turned on if the thermometer showed that the air was not sufficiently damp?—That is so.

5556. But is there any objection to the spray being always on?—No, except that there may be a time when there would be no spray on. It could be so arranged that there could be a tell-tale, and communications could be made to the cabin or even to the offices on the surface.

5557. Now, do you consider that with compressed air spray can be more conveniently arranged than without it?—I think so.

5558. You would prefer to use compressed air if the other circumstances allowed you to employ it?—I should prefer to use compressed air.

5559. Then besides the saturation of the atmosphere of the mine, are there any other precautions that you would take?—In shot-firing particularly?

5560. Yes, in reference to shot-firing?—To use an explosive that was flameless, or as nearly so as possible.

5561. What explosive do you consider is flameless?—I am using now absolutely ammonite at all our collieries, and I have been for the last two or three years, with very gratifying results, never having had any complaints from any of the shot-firers of their having seen any sparks or flame.

5562. Is there any complaint of bad gases given out by the explosive?—No, none whatever; it is spoken most highly of.

5563. You do not think that the use of powder is a necessity in any mine?—Not at all. This explosive is as strong as any of the high explosives, either gelignite or dynamite or any of them.

5564. In your experience you prefer it to all the others?—I do, from experience.

5565. Have you used any special apparatus in blasting?—I think I have tried them all. The first I believe that I remember was the Grafton Jones hydraulic wedge, which we tried in South Wales at the Powell Duffryn Collieries. I also tried Chubb's wedging machine (a series of cylinders), and Bidder's wedge (a hydraulic wedge). I have also used the compressed cartridge used in Staffordshire. That is a cast-iron cylinder compressed with air up to 15,000 or 20,000 cubic feet of pressure per square inch until really it burst. I had very gratifying results from it, but it was very expensive like the other process. I have also tried the lime cartridge in South Wales. Where I found that the coal was friable it practically spent itself in the slips or in the crevice in the roof and did really more harm than good, but where the coal happened to be very hard it worked remarkably well. I have also tried, of course, Sir Frederick Abel's water cartridge, but that is merely an envelope to envelop any of the ordinary explosives.

5566. With regard to these wedges, is it your opinion generally that they are not applicable?—They are not, they are very cumbersome to get from place to place, they are expensive and liable to get out of order, and they require a very large hole to be drilled. That must, in the majority of instances, be done by manual labour, and if a stone or a piece of brass or anything like that is met with in the hole, the hole has to be abandoned and a fresh one is started.

5567. And you think that if the precautions you suggest were taken, that is to say, if a flameless explosive like ammonite were used in shot-firing, and the air of the mine kept saturated, there would be practically no danger from coal dust?—Practically no danger. I should like to see the dust first removed, or some months to elapse before shot-firing was allowed in a dry and dusty colliery, so that the dust would become also thoroughly saturated or permeated with the water, not to have merely a scale on the surface.

5568. Have you had any gas explosions at your collieries?—Yes, we had one at the National.

5569. Did coal dust play any part in that?—Undoubtedly; but it was from a shot, and there may have been gas; we had no evidence to prove that there was no gas. We were then using, or supposed to be using, "Abel's envelope," but we discovered that they had been neglected to be filled with water, and the consequence was a most disastrous explosion.

5570. Is there anything else that you wish to say?—I do not know that there is anything that presents itself at present. We have had several very heavy outbursts of gas, of course, as we have in South Wales, which may account for many of these accidents, but I do not know that that would at all bear upon the question of dust explosions.

5571. (*Mr. Fenwick.*) With reference to the explosion to which you referred, and which occurred at Risca, was that the explosion in January 1882?—Yes, on the 15th of that month.

5572. I think you said that there was no evidence to show that it was a dust explosion, did you not?—I do not know that I said that. It was a dust explosion undoubtedly.

5573. Had there been found any gas there for some time previous?—No; none whatever.

5574. What distance was it from the shaft?—230 yards, I think.

5575. Do you remember the volume of air that was passing at the time?—I think it was about 60,000 cubic feet, between 55,000 and 60,000.

5576. I observe in the report which is given of that explosion that it is stated by the inspector, Mr. Cadman, that the gas was supposed to have come from some old workings; were there any old workings near to where the shot was fired?—None whatever. None

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near, as you can see by the plan, and as can be seen to this day, there are no old workings near it.

5577. (*Sir William Lewis.*) Have you always been of the opinion that the explosion was due to coal dust?—It was my conclusion then, as it is now, that it was due to coal dust.

5578. You held that opinion then?—Certainly; and I gave evidence to that effect before the coroner.

5579. Then with reference to the National explosion; in examining the effect of the explosion throughout the workings, did you observe whether it was intermittent; that there were traces of dust to be found, and then that they ceased for a time, where there was water or any dampness?—That was so.

5580. That was the result of your investigation at the National?—That was the result of our investigation.

5581. Were there any similar indications in Risca, when you examined that after the explosion?—Yes, there were; but they ceased going in one direction, I may say, at a water parting which we had, not very far from the seat of the explosion.

5582. Do you happen to remember noticing the extent that it may have leaped over a damp place?—No; it ended at these damp places. There was a length of dampness, in fact the timber and everything was thoroughly saturated, and it ended there.

5583. Do you use water cartridges at present?—No, I use ammonite pure and simple. This is one of the cartridges (*producing cartridge*). Of course it is not filled with the explosive, it is filled with plaster of Paris. That is the description of cartridge we use.

5584. After the explosion which you had at the National, and which you said was due to the neglect of the men in not filling the cartridges with water, you have ceased using them?—Yes, we have ceased using them.

5585. And so far as you have had experience of ammonite you consider it is perfectly flameless?—Perfectly flameless according to all the experience and according to the experiments with it which I have been making within the last few days.

5586. Have you had any blown-out shots?—Lately?

5587. With ammonite?—Several.

5588. Have you had blown-out shots in the neighbourhood of dust?—No; we thoroughly water the neighbourhood of wherever any shots are to be fired, and really where we are firing shots it is in a wet seam, and we are not shooting in the very gaseous places.

5589. Do you use ammonite in the face in coal getting, or simply for taking down the roof?—For taking down the roof only, not in the coal.

5590. You use no explosives in the actual coal getting, do you?—None.

5591. Would you consider it possible to carry on the collieries of South Wales without the use of any explosives?—Impossible at a profit.

5592. It has been suggested to the Commission by a witness that it would be very desirable that firemen should report the existence of dust as well as the existence of gas (if either gas or dust did exist) in their inspections in the morning; do you think that would be any advantage?—Yes, it would; but then it would be a question as to the extent of the dust, and as to their private opinion; in one man's opinion it may be very dusty and dangerous; and in another's it may not.

5593. Would it not be very difficult to define?—Very, indeed.

5594. Would it not be better to rely upon the present provisions, that the dust must be removed and attended to before any shots are fired?—I think so. On second thoughts, I do not see really that it could be put into the hands of a fireman, in fact of any individual. I think that all the precautions of the Act should be carried out in their entirety.

5595. (*Mr. Bainbridge.*) With reference to this Risca explosion I should like to have a little further explanation; you were the manager at the time, were you not?—I was.

5596. It was a dusty mine?—Yes.

5597. I see that Mr. Cadman, the inspector, remarks, "I should here remark that the main roads are regularly watered," was that so?—They were watered by watering cans or water tanks, and the atmosphere was not saturated as it is at present.

5598. Were the roads in the immediate neighbourhood of these shots watered?—I may say that the roads were perfectly damp, as hard almost as this table, it was on the sides and the roof where there was probably a quarter of an inch of dust, impalpable dust, adhering.

5599. No provision was then made in regard to the dust which adheres to the roof?—None then.

5600. Would you say that Mr. Cadman had no reason for stating what Mr. Fenwick mentioned just now as to the firing of shots causing gas to be drawn out of the old workings?—None whatever upon the face of it.

5601. You refuted that at the time yourself?—Certainly.

5602. What was the result of the Risca explosion with regard to your own watering arrangements? Did you, then, from that time carry out some plan for watering the dust above as well?—Yes, and we ceased shot-firing. We have never fired a shot in that seam since.

5603. Not of any kind?—Not of any kind.

5604. But now that you have your new experience with ammonite, would you think there was any danger in firing shots?—No, not a bit; we are using it in the seam below, in the lower black vein, not in the black vein proper. We do not require it there, it is a thick seam about 9 feet, and we do not require it.

5605. You have got in the habit of not using shots there, and you have not used them?—No, we have not required them; if we did require them they would be required in this place where the shot was fired before. That would be the only place where we would require a shot.

5606. In your judgment, as to what coal dust would do and not do, I note that you differ from Mr. Martin?—Yes.

5607. In spite of that you both adopt the same precautions?—I adopt precautions in watering the mine.

5608. And so does he, but you think that coal dust is much more dangerous than he does?—There is not a doubt in my mind. Even last week I made experiments in a tube, and fired coal dust alone repeatedly with dynamite.

5609. With regard to the proposal that you made as to an automatic record of the condition of the mine, is it not your experience of automatic matters in coal mining that they are not very reliable?—If they are properly taken care of they are reliable, and I have heard several instances of this working most satisfactorily.

5610. Would you not feel more inclined to rely upon a well arranged discipline of the mine, making sure that your manager, and for a certain number of hours of the day your under manager, had to look after these sprays?—I would have both.

5611. One would check the other?—Yes. This is a matter which occurred to me yesterday, and I have not had an opportunity of thinking it out, but I thought such a thing would be possible.

5612. With regard to the use of ammonite, as we have not heard very much of that before on this Commission, perhaps you can tell us a little more about it. Is anybody else using it beside yourself?—Several places in the north of England and in Staffordshire, and a number of places in South Wales.

5613. And you have never found a flame at all with it?—I have never seen a flame, and I have seen hundreds of shots, that is, not when it is properly tamped. If you fire it without tamping it you may get a flame. I tried it in the experiments I was speaking of last week and then could not get a flame.

5614. Without tamping you do?—Without tamping you do. I fire it with a fulminate of mercury cap.

5615. That applies to all the so-called flameless explosives?—Certainly.

5616. Then with regard to its economy, is there much difference between the cost of working with that and the cost of working with powder?—No.

5617. What does it cost?—About 1*s.* a pound.

5618. And you use about one half of that compared to what you would use of powder?—Much less.

5619. And you use a much smaller hole?—Yes. I have produced a sample of the explosive.

5620. Does that represent the size of the hole?—In some instances; we have had very much smaller ones, even as small as the capsule at the top of that explosive I have produced.

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5621. In the cases where you have adopted ammonite, have you gone so far as to countermand the use of powder altogether?—Certainly.

5622. You have excluded gunpowder? — We have excluded every other explosive than ammonite.

5623. With regard to the question of explosives generally in South Wales, do you go so far as one witness we have had, as to say that in your district the exclusion of explosives would increase the cost of working in most mines by 6*d.* a ton?—In some instances much more.

5624. More than that?—Very much more; in the mines I am connected with it would be very much more; 1*s.* would be nearer the mark, if not more than that.

5625. Then if you came to the conclusion that you had in ammonite, or any other explosive, an absolutely flameless explosive, would you think it necessary on the ground of safety to continue your precautions with regard to coal dust?—Certainly.

5626. Why?—I should certainly do so.

5627. Would you do so as a matter of additional safety?—Yes.

5628. As well as for sanitary reasons?—As well as for sanitary purposes.

5629. Now, with regard to the wedges, you seem to have tried them nearly all?—I think I have.

5630. There is one wedge you may not have tried, and that is the long feather wedge in which the manual labour is considerable?—Yes, I have, I am using it just now.

5631. How do you find it answer? — Very well indeed.

5632. In spite of the hard work it entails?—Yes.

5633. How long does it take to break the coal down? —I have not used it in coal directly, our coal is a friable coal.

5634. You do not shoot in the coal?—We do not.

5635. Then the explosive or wedge is required entirely for the stone?—Yes.

5636. You are not shooting in the coal?—There is no necessity.

5637. How long does it take to break the stone down?—That varies according to circumstances, and depends entirely upon the nature of the roof. In an ordinary shale roof a very few minutes are sufficient; if it is very hard it may take two hours, and then you would only get a capful.

5638. You would regard the wedge as much safer than the most flameless explosive?—I would.

5639. Why is it not more largely used?—On account of the expense and the slowness of the process.

5640. The expense, of course, is much less per day, but much more in the first cost; an ordinary feather wedge does not cost very much in wear and tear, does it?—No, very little.

5641. It is the first cost of the wedge?—Yes, but that is not very considerable.

5642. Do the employers find the wedge or the men? —The employers find the wedge in the instances in which I have used it.

5643. And you find the wedge answer pretty well?—I find it answer very well indeed.

5644. (*Lord Rayleigh.*) Do you think any further experiments are required to elucidate the behaviour of coal dust?—Certainly; there cannot be too many, I think. There is not a great number of people who really believe in it now.

5645. Are these people capable of being converted by any experiments?—Really I do not know. Some of them are very hard to make believe.

5646. Have you any particular experiments in your mind as desirable?—Yes, I think that they should be conducted upon the lines laid down by Mr. Galloway. I think they are very desirable.

5647. What are the particular issues? — Merely having a long gallery, a level heading on the surface.

5648. On what scale do you think it would be necessary?—Upon the same scale as we have them underground.

5649. Are you of opinion that experiments upon a smaller scale would not serve the purpose?—They are sufficient to convince me and to convince all those who are under me. I had some experiments even last week. But some people are rather sceptical. My experiments were in a boiler merely, about 12 or 14 feet long, trunk-headed ends and filled with the proper proportion of explosive mixture of coal dust and gas, and the different explosives fired into it with tamping, and without tamping, and with very little tamping; and almost all the explosives we tried, with the exception of ammonite, caused an explosion—in fact, all those which really had solid bodies in their component parts, but all those that resolved themselves naturally into gases there was practically no danger from.

5650. Then the experiments you have in view relate rather to the comparison of the different explosives among themselves? — Those that I have been conducting were simply to show, for my own guidance, the result of using these explosives in gaseous mixtures.

5651. Do you think that further experiments are necessary in order to settle the question as to whether an explosion could be propagated over long distances by dust only?—It is such a very difficult matter to get a chamber long enough.

5652. What sort of length do you think would be necessary?—You would practically require a gallery; a chamber of 200 or 300 yards long would hardly meet the case.

5653. And of what diameter?—Say 8 feet by 7, the width of an ordinary heading.

5654. Do you think that experiments upon a smaller scale than that would hardly meet the case?—They would hardly convince people. I think the smaller experiments point to the conclusion that coal dust is explosive. I do not see that there is any necessity to carry them to a much larger extent; except to convince those who are sceptical, there would be no great end to be gained by it. The fact has been established beyond a doubt in my mind.

5655. In your own mind the experiments still most required relate rather to the comparison of different kinds of explosives?—I think so.

5656. (*Sir William Lewis.*) Following up what Lord Rayleigh has been asking you about as to the advantage of further experiments, do you think there would be an advantage in convincing the workmen as to the danger of coal dust?—I think it would be of advantage.

5657. Do you think they would be convinced except the experiment were upon some such scale as a colliery? —I think the majority of them would be convinced if a large chamber was constructed to the extent that I am speaking of, and to the extent suggested by Mr. Galloway. It would be practically impossible, I think, to carry them out underground, as you are aware.

The witness withdrew.

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Mr. Richard Bedlington called and examined.

5658. (*Chairman.*) You have been engaged for a long time in the management of collieries, I believe?—I have, for 50 years.

5659. In what district?—For a great number of years in Monmouthshire and then in Glamorganshire.

5660. I believe you have been president of the South Wales Institute of Engineers?—Yes.

5661. I suppose you are acquainted with many collieries in different parts of England?—I am.

5662. You are also consulting engineer to a number of collieries?—I am consulting engineer at collieries producing about a million tons a year.

5663. Now, with regard to the explosions in Wales, what has been your experience as to the cause?—I have in many cases examined into the question after an explosion, examined the workings and everything to try to arrive at a conclusion as to the causes, and in what part of the workings the explosion took place. In other cases I have carefully read the evidence. My

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experience over all that period which I have named is that I do not know of a single colliery explosion that was not caused by gas.

5664. That is to say, the explosion was initiated by gas?—Yes.

5665. Do you consider that dust has played any part in the extension of the explosion?—Yes; I consider according to the quantity of gas there will be an amount of flame, and that that licks up, to use that term, the dust in the immediate vicinity and cokes it. According to the quantity of gas the flame will go a certain distance, but I think the scorching at great distances is caused by the heated air and by the coked dust. The force is very great where much gas is ignited; I have felt it in a less degree in the workings myself, and I say the force is very great by which the heated air is passed through the workings and the coked dust, and that scorches men, horses, and timber.

5666. Do you think that the ignition of the coked dust in itself produces an explosion?—No, I do not. In all my examinations of these cases I have had no reason myself to arrive at that conclusion. I believe it aggravates an explosion of gas.

5667. Does it carry it further than it would otherwise go?—I think not so much in flame as in coked dust, which, of course, scorches. I have laid my hands upon men, horses, and so on, and I have found that they are often covered with the coked dust. When the coked dust is in a heated state like that it would no doubt more or less scorch.

5668. You do not think it adds to the explosion?—No, I think not; not in a large degree.

5669. In the coking of this dust would not gas be disengaged?—In a small degree. I have seen the gas exploding underground and felt the effects of it. It seemed to me to be a mass of flame. As I say, it does ignite the dust; but I do not think it adds materially to the mass of flame caused by the gas explosion. I have suffered, and I am one of the persons who have seen gas really exploding.

5670. In a mine?—Yes.

5671. On what occasion was that?—One was, I should think, nearly 40 years ago. There was a certain amount of gas which was not known of; the man advanced into it, and I happened to be about a chain from him. I did not know whether the place was right or not, but I happened to be measuring the stall and I saw the mass of flame in the stall. I threw myself on my face and it passed over me. Then there was the vacuum caused by the first explosion, the air rushed back, and then came back over a second time. The last time I suffered from the effects of gas I was by myself and was surrounded by flame. I was very badly burned on that occasion. So I more or less have seen what would be the effect, though, of course, it would be in the great explosions so much more, according to the quantity of gas there.

5672. Do you think it necessary to take any precautions against dust in the way of damping the mines?—I think the Mining Act provides, where a mine is dry and dusty and at all likely to contain gas, for the damping of the dust at that point and in the immediate vicinity.

5673. Do you approve of that precaution?—Well, it is a precaution, but I do not know, according to my long experience, that there has been any case brought home in which even a blown-out shot has caused an explosion. There are so many thousands, and tens of thousands, and hundreds of thousands, of shots put off without any ill effect that you cannot provide for a remote contingency. It is just possible, it may be, but still it is not what we would call a practical danger.

5674. Then if you had to decide you would not even take the precautions which are now ordered by the Mines Act?—I would not think it necessary, but I would say as it is a precaution one cannot be too careful in regard to these matters; still I would not think it really necessary, because from a long experience I have not seen any ill effects from it.

5675. Do you think it necessary to clear the dust away?—I think it is desirable as a matter of nuisance, of annoyance on the roads.

5676. But not necessary to prevent danger to life?—Not to prevent danger. I do not think it is any danger to life; but still, of course, you do not want to be inhaling dust if you can help it.

5677. I think we may take it for granted that you do not think it necessary to take any special precautions with regard to explosives either?—In what way?

5678. To use flameless explosives in place of powder?—Yes; the careful handling of it.

5679. Do you consider it necessary in blasting and shot-firing to use some of these flameless explosives?—It would be desirable. If there is any doubt upon the question at all, and it can be obviated by the use of safer explosives, all the better.

5680. Only I understand you to say that you do not think there is any danger?—Not from dust exploding, that is what I mean.

5681. Therefore so far as dust is concerned you would not think it necessary to alter the character of the explosive?—Not on account of the danger from dust explosions; but, of course, if you have a flame where there is any gas, then I believe that precaution is necessary. You may examine a place and find it quite clear, or you may find that you are not justified in firing a shot at all. The issue of gas is a very uncertain sort of thing.

5682. Yes; but we are dealing specially with dust?—As a matter of precaution against dust I do not think it important. I have examined into numbers of cases, and it is not necessary for us to suppose for a moment that the great explosions which have taken place, or even the minor ones, were caused by any ignition of dust *per se* without gas.

5683. (*Lord Rayleigh.*) Do I understand you to doubt that an explosion might be carried on by dust only in the absence of gas, supposing it were initiated, for the sake of argument, by gas?—I think that very likely the flame might be aided in passing, but that it could not go, as I have heard opinions given, for miles through workings, not any amount of flame as flame. I think the greater the amount of gas you have, the greater the amount of flame, and the heated air carries the effects so much further; of course the skin is delicate, and the hair is delicate, and the heated air scorches at a great distance. It is not necessary when you find a scorched body to suppose that the flame extends so far as that. I believe that a great mass of flame heats the air up to a certain point, and that you will have the effects extended in that way. It is just possible, as I have just said to the Chairman, that dust aggravates an explosion, but does not explode. I do not know of any case whatever in which dust alone has caused an explosion.

5684. My question relates to this case. Supposing that there were a long gallery throughout the whole of which there was dust, but at one end of it only there might be gas, and that the ignition took place at the end where there was gas, do you consider it impossible that that explosion should by means of the coal dust penetrate to a long distance, where there was no gas?—I say if you have gas exploding and causing great flame, as I have seen it, then it licks up the dust, and no doubt it continues the flame farther.

5685. To any extent?—It would be difficult to say; according to the amount of dust.

5686. Supposing there was sufficient dust?—If you throw fine dust upon that coal in the grate which is now existing as a fire, then you will have flame. No doubt the flame will be extended by dust, provided there is any quantity. But I may point out that in our roadways, for instance, it is so mixed up with rubbish and dirt of every sort that you can hardly expect it to take flame. The only places likely would be in the upper part of the headings.

5687. We have it before us in evidence that there are galleries throughout which the dust is in a highly inflammable state?—Many of the experiments which have been made are not what you would expect would occur in a colliery; for instance, the early experiments upon the subject, in which you had the finest dust provided for you, and fired a cannon into it, and all that. I hardly think that anything of that nature will do; you must have something similar to what would occur in a colliery.

5688. But surely there can be no better initiation for an explosion than the ignition of gas at one end of a gallery?—I admit the gas, and that the effects of the gas exploding are aggravated by dust.

5689. But that is to say, aggravated only where the gas is. My question was whether the explosion might be carried by the dust to a great distance from the place where there is no gas?—After the gas has exploded?

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5690. Yes ?—Yes, I say it is aggravated and carried further.

5691. But much further ?—That is if you get dust; I do not think so much in the roads, I think it would be in the upper part of the galleries; the finest dust would lodge there. As for the roads, it is trodden down so much that it is hardly likely to be, but about the upper part of any of the galleries you would have the finest dust lodging. No doubt if the flame extended to that, the dust would also be ignited by the flame and extend it and carry it further; there is no doubt about that.

5692. Would there be any limit to the distance to which an explosion might be so conveyed by the dust ?—Yes, from my examination after explosions I could not say that there was any reason to suppose that the flame had extended any great distance. The flame was according to the quantity of gas. To tell me that flame in any explosion will be carried a mile or two, as I have heard gentlemen state, is beyond my powers of belief. They certainly have had no reason for that opinion.

5693. (*Mr. Bainbridge.*) The general effect of your evidence appears to be that you think that coal dust by itself in a mine need not be considered a serious danger ?—Not as a serious danger, except as to the after effect in a gas explosion.

5694. I mean by itself in the mine ?—By itself, not.

5695. Is there anything else, as the result of your long experience in dry and dusty mines, that you wish to bring before the Commission ?—Of course, having regard to its annoyance in the workings, I should think dust ought to be cleared off the roads and so on; but it would be a very difficult thing to effect it in every part of a heading. It lodges in the crevices and lodges in the top of the timbers and places of that sort, and you cannot reach every place, even where the mines are watered by pipings. It is generally on the main ways that the piping is laid.

5696. Have you a dry and dusty mine under your management now ?—Yes, most of the workings are dry and dusty.

5697. Which is the most dangerous mine you have to do with ?—The most dangerous now ?

5698. Yes, as to either dust or fire-damp ?—I could not say that we have any specially dangerous mine, but nearly all the deep mines now are necessarily dry and dusty.

5699. Are you carrying out the precautions of the Mines Act with regard to the dust ?—Clearing away dust on the roadway ? That is what I direct my attention to. There is no place in which I have adopted pipings throughout the workings. As I say, there is an objection to watering the roads, that it softens the stratum. I know that in many cases it loosens the timber. It is a very awkward thing to go and soften the foundations of your timbers.

5700. Do you carry the water in tanks ?—I have been in places where it is carried and a spray allowed to cool the air and lay the dust. I have examined such places.

5701. What do you do in your own mine with regard to dust ?—We do not do that at all; we do not find it necessary.

5702. Not to water them ?—In the present state, no.

5703. Then you adopt the principle of removing the dust ?—Yes, that is what I prefer.

5704. And not watering ?—Yes, I prefer taking it away.

5705. What is your experience of explosives; are you using gunpowder ?—The colliers use a variety. Some keep to gunpowder, others use compressed powder, some use gelatine, and some dynamite when they are obliged to rip rocky roofs and so on.

5706. Do you allow the colliers to choose their own explosive ?—Of course we would have a veto upon it. We have had no accidents from any of these explosives in the mines I am connected with, but in past times I have seen powder carelessly handled by colliers. I remember an instance of this sort. We did use candles in the old times, you know, and with a piece of clay they used sometimes to stick a candle up on a timber. That was a very convenient thing to them. I remember an accident occurring to a couple of men who were making their cartridges—that was allowed at that time—and they allowed the clay to dry, and the candle fell on to the powder which they were handling just beneath it. That was in past times. The cartridges are not allowed to be made underground now.

5707. I think I gathered from you that the conclusion you had arrived at was that in all your experience you had never known of a case of a blown-out shot firing coal dust by itself ?—That is so.

5708. Therefore you think such a danger is not to be feared ?—That is so.

5709. I suppose if there was a single case of such a thing coming to your mind, that would alter your view entirely, would it not ?—If there was such a case. Still I would say it was such a remote contingency that it would be hardly fair to make hindrances in the working of the collieries simply because you had had an occasional case of that sort.

5710. Supposing you found a case where firedamp was absolutely certainly absent and an explosion took place from coal dust alone, would that alter your view ?—My experience would tell me to the contrary, and I have examined into a great number of cases where explosions have taken place and there was no reason whatever to suppose that the explosion took place from dust alone.

5711. Are you familiar with the Risca explosion in 1882 ?—I have heard that matter debated and considered, and I cannot say the exact circumstances. I have been in that pit, and I have been, I suppose, near the place where it occurred, but to say whether I knew whether there was gas there or not, I could not tell you that. I did not examine it at the time; it is the only case in South Wales that is even mentioned as probably due to dust. It was on the intake, and I fail to understand how there could be much dust there at all. It was not very far from the pit on the intake, and where the dust was to come from to explode I do not know. I have walked along the place. Of course I cannot definitely say that it did not take place, but still it is a doubtful case.

5712. Then do I gather from you generally that in every case where the evidence has been that, as far as one could judge, there is no gas, and yet an explosion has taken place which appeared to be due to coal dust alone, you think the evidence cannot be correct ?—It is a matter of opinion.

5713. No, it is a matter of evidence ?—The difficulty is to say that there was no gas there. The most probable cause of an explosion is gas, and you must bring it clearly home that there was no gas there. Now, in some of the earlier experiments in Germany, there was used a long box with the finest dust. We know that with very fine coal dust gas is readily evolved, so much so that we used to take precautions underground long ago to prevent heaps of small coal being accumulated in the workings, because the smaller the coal is the more readily the gas is evolved.

5714. I would rather put a case of an actual explosion to you. Take a case like Seaham, Elemore, or Altofts, three very typical cases which have been brought before us here, where the evidence was that there was no trace of gas for hundreds of yards round the point of the shot; how would you explain that ?—It is not within my experience whether that took place. I am only speaking of the experience I have had during the last 50 years, that is all I can say. What has taken place elsewhere of course I cannot know the circumstances of. People, even after an explosion, have different views of how it took place and where it took place; that is the result of my experience.

5715. (*Sir William Lewis.*) What would you require to convince you that an explosion might be created by dust alone ?—I would say this. Take a coal in which no explosive gas has been seen for 20 or 30 years, or 100 years——

5716. Coal or a colliery ?—I know such coal in which gas has never appeared at all.

5717. Are you speaking of a coal or a colliery now ?—I am speaking of a vein of coal from which no gas has ever been seen at all, within my knowledge, and I have had a long experience of it. Take that coal and crush it and make it into small coal, and see whether you can explode it.

5718. Is that what you require to convince you that it is possible ?—Yes, with the dust from a vein of coal in which no gas has ever appeared, then I would be satisfied that coal dust, *per se*, would cause an explosion ;

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that is, tried under circumstances likely to arise in a colliery. Firing cannon into small coal, and all that sort of thing, is not likely to occur in a colliery.

5719. Assuming a gallery is constructed on the surface, of the dimensions usual in an underground mine, and inside of that you have a blown-out shot, either with powder or with what is described as a flameless explosive, and that the place is covered with dust, and pretty much in the condition that some of our steam coal collieries are in South Wales, and that you had an explosion from that blown-out shot, where there could not possibly be any gas—would that convince, Mr. Bedlington?—With such a condition as I have intimated, that no gas has ever appeared.

5720. This is on the surface, there is no coal there, there is no gas; every precaution is taken that no gas could possibly be there?—It depends on what it is.

5721. We have a blown-out shot among fine dust, dust prepared from any seam you like to mention as being worked in collieries in South Wales, and with that blown-out shot create an explosion, would that convince you as to the possibility of dust initiating an explosion?—It would convince me if you used a small coal which never produced any carburetted hydrogen. I am telling you of a case of a coal I know, in which no gas has ever been seen. If you go and fire into that a blown-out shot and get an explosion I would say that it was due entirely to the coal dust itself. But, as I say, if you take the gaseous coals you do not know what evolution of gas has taken place from them on the surface. Then again, your gallery must be well trodden down by men and horses, and so on, and you must take only the chance of having a little dust on the top of the gallery. You do not expect me to think that simply on a road which is continually walked over by horses and men, and so trampled down, you are going to have that in the same state as the finest dust.

5722. That is what a colliery is. No; but assume the same conditions as are in existence in collieries in South Wales, which both you and I know very well, where the steam coals are being worked, and that there was a blown-out shot at the end of a gallery where every precaution has been taken against the possibility of gas existing, and that you then have an explosion; would that convince you that dust could initiate an explosion underground?—No, it would not convince me until you use a coal from which no explosive gas issued.

5723. Why should you do that; why should you use any other coal or dust or any other seam than we are working every day? You know we have a large number of seams that are known to be fiery; let us have the dust from those fiery seams, and would you then be convinced?—If you do use small coal from fiery seams gas issues from it.

5724. Then it would be doing so every day underground?—You could not distinguish then whether it was from gas or whether it was from dust.

5725. Very well then. Are you not making the admission that it is so underground every day, if that is where the gas comes from. If firing a blown-out shot into dust would initiate an explosion either on the surface or underground under the same conditions, would that not convince you?—Under the same conditions, but your galleries are made for a special purpose, they are sprinkled with nothing else but fine dust, which is not exactly what takes place in a colliery; trample that down ——

5726. Forgive me, you have not taken notice what conditions I have asked you to assume?—The same conditions?

5727. The same conditions as are in existence in a mine?—I do not think that has taken place in the experiments made as yet.

5728. No, I have not said that. I said assuming that there were experiments under precisely the same conditions as exist in a mine, would not that convince you that an explosion could be initiated by coal dust?—Yes, it would, but at the same time I must say that we must go by the experience of actual working in collieries. If such things take place they would take place frequently. Explosions are infrequent and the causes of them are generally traced to gas. There is hardly a case in which there has been any proof that any explosions have taken place, I am speaking of South Wales, which I know best, in the absence of gas. You have always been able to show that there has been gas.

5729. That is, you have been satisfied that there has been gas?—On the evidence that has been given at the various inquests.

5730. Have you ever seen a blown-out shot in coal dust in a colliery in South Wales?—I have been near one.

5731. A blown-out shot with a flame?—With a flame showing not nearly so far as some people have testified. But I have seen it, we will say as far as my recollection carries me now, and I have been very near one, about four or five yards I should think, mixed up with flame and sparks.

5732. But not much of a flame?—Not in that case, but it was mixed up with some flame, some sparks.

5733. Was that in a dry and dusty place?—Yes, I should say it was.

5734. And the dust had been cleared away?—No, I think not. That was many years ago. I have not seen any blown-out shots recently. It is a very rare case is a blown-out shot.

5735. Was it in a confined space?—It was in a stall.

5736. Was it in the direction of the roadway or was it across?—As far as I recollect it was at right angles from the side, blowing towards the roadway; that is as far as my recollection goes now, it was many years ago, but I have got an idea of the place before me now.

5737. Into the gob then?—Towards the gob; as I say, I have not seen any blown-out shots in recent years, and altogether it is a very rare event. Generally what we do find is that the shots fail and then there is a certain interval of about 24 hours to elapse before the new shot is allowed to be put near it in order to be quite certain that there is no holding back of the fire. That occurs frequently. Then there is a mark made in the stall to prevent anybody going into that stall till the following day.

5738. You said in reply to Lord Rayleigh that the existence of dust might extend the effects of an explosion, but would you not go further and say that the explosion would extend so far as the dust continued along the galleries?—No, I do not think so, because it must gradually lessen; the flame due to the explosion of the gases would become weaker and weaker.

5739. Then you are not of opinion that it would feed upon the dust as it went along?—No, I do not think from the examination of explosions which I have made that it was necessary to suppose any flame. If you had flame it would fill the whole heading, and everybody knows that after an explosion when you begin to examine the workings you find the scorching is on the one side of the timber and not round the timber; it seems to be next to the main passage. If the timber is on the side you see one side scorched, but if you had the whole gallery filled with flame you would not find on one side of the timber that there would hardly be any scorching at all.

5740. Have you not been able to ascertain pretty well the extent that an explosion has spread through the workings by the effect on the timber or the sides or the bottom by charred coal dust?—Yes; but then the question is whether in addition to the flame the air heated to a high degree by explosion does not extend the effects further. It does not necessarily follow that it was flame scorched the place. It may be heated air, for we know that that, of course, will scorch, especially such delicate things as skin and hair.

5741. Then you are still of opinion that it would not extend so far as the dust continued in the gallery?—No, if it did that of course it would go through all and every part of the workings, and we have no reason, in the examinations we have made, to think that it was so. I am simply giving you the result of my experience without regard to any particular theories at all.

5742. (*Mr. Fenwick.*) Have you had any occasion to examine a mine after a large explosion?—Yes, on several occasions.

5743. Did you find on any occasion that there were indications in the mine that the flame had passed over a certain portion of the mine and again showed indications of its existence further on?—I have seen it up to a certain point where we generally expect it would take place, but I have seen the effects of an explosion cease after a certain point.

5744. And recommence again?—No; I have heard of such cases, but it is not within my experience. I

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have heard that at an angle or at the end of some particular heading it has leaped over an intervening space. Why that is I do not know; I have heard of such cases, but I cannot say that they are within my own knowledge.

5745. Such a case has never come within the range of your own experience?—No, I should think not. I could trace the passage either of flame or of highly heated air producing certain effects upon the return, but other parts of the workings which would be equally dry and dusty have shown no effects whatever of the explosion, in fact men have come out all right from certain parts.

5746. Are the mines of which you have experience in South Wales considered fiery mines?—I have had to do with fiery mines.

5747. And dry and dusty mines?—Yes, all the deep mines will be more or less dry and dusty, because, of course, of the depth.

5748. Are there any in that condition now that you are connected with?—Nearly all the deep mines are dry and dusty to a certain extent, but it is difficult to say to what degree.

5749. Do you take any other precaution against an explosion than the removal of the dust?—The removal of the dust on the roads, and then wherever safety lamps are used have regard to the watering in the vicinity of the shot, and the places where the shot is to take place.

The witness withdrew.

Adjourned.

At 23, Great George Street, Westminster.

FIFTEENTH DAY.

Friday, March 25, 1892.

PRESENT:

The Right Hon. JOSEPH CHAMBERLAIN, M.P., Chairman.

Lord Rayleigh.
Sir William Lewis.
Mr. Charles Fenwick, M.P.
Professor Harold Dixon.
Mr. J. Wilson, *Secretary.*

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Mr. Frank Brain called and examined.

5750. (*Chairman.*) You are a member of the Institute of Civil Engineers, are you not?—I am.

5751. You are also a member of the South Wales Institute of Mining Engineers?—I am.

5752. And you are also on the executive council of the National Association of Colliery Managers?—Yes.

5753. I think you are a manager of a pit in the Forest of Dean?—Yes.

5754. What is the name of it?—The Trafalgar Colliery.

5755. Is that an important colliery?—It is one of the largest in the Forest of Dean, employing about 750 men.

5756. I suppose you have had large experience of the working of collieries in the Forest of Dean?—Yes. I have been intimately associated with the working of the Forest of Dean collieries for the past 20 years.

5757. Have you read the evidence which has been given before this Commission?—Some portions of it.

5758. Have you considered the question of the influence of coal dust on explosions?—With relation to the Forest of Dean, I have.

5759. Now we have been told that even without the presence of explosive gas it is possible that coal dust may initiate an explosion. What is your opinion about that?—My own opinion is, decidedly not.

5760. I think that the Forest of Dean mines are not explosive mines?—Explosive gas has never been found in the Forest of Dean.

5761. Has the Forest of Dean been free from explosions?—Quite free.

5762. Are you aware whether there has ever been in the Forest of Dean an explosion caused by dust?—I have made very extensive inquiries on the point, and my own experience is decidedly not, and from inquiries that opinion has been very strongly confirmed.

5763. Are the mines dusty mines?—Some of them.

5764. Is shot-firing practised there?— Yes, very largely, with gunpowder.

5765. Consequently, there are frequently blown-out shots?—Not very frequently, but occasionally that would happen.

5766. You have never known, however, a blown-out shot to be followed by any kind of explosion?—Never.

5767. Has your attention been drawn to an explosion which took place the other day in a Radstock pit, the No. 4 Pit?—I heard a little of it; I think it was Mr. McMurtrie's.

5768. Yes. Do you know that pit?—I have never been down it.

5769. Do you know whether this pit is a dusty pit?—I believe so.

5770. In the report that I have it is stated that the explosion in this case was an explosion caused by a blown-out shot?—You refer, I believe, to an explosion which took place some two or three months ago?

5771. Yes, it was from a blown-out shot. The mine is not a fiery mine, is it?—Not that portion of the mine.

5772. How do you account, then, for that explosion, which I believe traversed about 40 or 50 yards, if it was not a purely dust explosion?—I think I should hardly call it an explosion, but rather put it as a prolongation of the flame from a blown-out shot, and taking that view of it, it is strongly confirmatory of my opinion that coal dust, such as is found there, would not cause the explosion.

5773. You do not mean to say that the whole of the explosion or ignition was due to gunpowder?—No; if you will allow me to explain myself, I think it has been proved very conclusively by experiments conducted by Professor Abel some few years ago, both at Wigan and at Chatham, and also by the experiments conducted by the Prussian Commission on this very important question, and confirmed by the experiments conducted by the French Government.—I think it has been proved in all those cases that coal dust alone would not cause an explosion, at least these were the opinions arrived at by those gentlemen as the result of their experiments, that coal dust alone would not cause an explosion; but where a flame is given off by the firing of a shot of gunpowder such as was the case with this blown-out shot at Radstock, that flame would under certain conditions ignite the surrounding coal dust and would be considerably elongated as a consequence by the addition of the flame in the coal dust, to the flame given off by the blown-out shot.

5774. Then when you say that coal dust will not initiate an explosion, you mean that it will not spontaneously ignite, but there must be a flame in order that it should ignite?—What I mean is that it is not possible for the coal dust to carry on the explosion to any great length; that it may add additional fuel to the fire given off from another cause for a few yards, but that it dies out at a short distance, comparatively speaking. For instance, with reference to the Radstock explosion, from the information given me, this particular place was dry and dusty; the flame from the blown-out shot appears to have ignited the coal dust immediately surrounding the place, and the flame was carried some few yards along the face of the coal, but a comparatively few yards only, although there was found an abundance of coal dust for hundreds of yards further on. If the coal dust itself had been sufficiently dangerous to give off an explosion, I am at a loss to know why the flame was not carried on more than a few yards. Why was it not carried on all along that face of coal, because there would be ample contribution from coal dust in that immediate vicinity to carry it for 100 or 200 yards, as the case may be?

5775. How far would the explosion from the blown-out shot alone carry, supposing there had been no coal dust there at all?—That would depend upon the position of the shot, and the quantity of gunpowder in the hole, and the amount of ramming upon it, and various conditions; but broadly speaking you may say, 4 or 5 feet, or 6 feet perhaps.

5776. Well, this explosion was carried on for 40 or 50 yards?—I am informed that it was about 30 yards.

5777. Professor Dixon says that a man was burnt at a distance of 30 yards and the explosion went beyond that?—Perhaps it may have been. I am quite willing to take that view of it.

5778. Might not the fact that it stopped after going 50 yards be accounted for by a damp place or by a siding in which there did not happen to be much coal dust?—I very closely inquired into that point because I saw the importance of it, and I was assured by the gentleman who has charge of the mine that there was abundance of coal dust at the extreme points to which the flame was traced, and that there was no damp whatever, and that the conditions for carrying flame were quite as favourable at the last point where the flame was found, as at the first point at which the flame commenced.

5779. Is the Radstock Pit a pit in which there are stone workings?—I believe so.

5780. Would not the presence of stone dust with the coal dust make it less explosive than if it were pure coal dust?—That may or may not be.

5781. If the dust happened to be mixed with stone in certain proportions that would stop the explosion, would it not?—The experiments conducted, I believe, so far as my knowledge goes (which perhaps is somewhat limited on this matter, so I speak with deference), but these, as I follow them, vary very much on that point. Under certain conditions it has been shown that the presence of stone dust has a tendency to stop the explosion as you now suggest; but by other experiments it has been shown that stone dust in considerable quantity, I think even to the extent of more than one-half the mixture, has not interfered with the violence of explosions from coal dust.

5782. What I want to put to you is this, that the fact that an explosion so carried on without gas for 40 or 50 yards further than it would otherwise have gone, is a proof that coal dust can very considerably prolong an explosion, and the fact that it did not go still further might be accounted for by the exceptional condition of the dust on the road in that place?—I should like to point out that there was not a roadway where this dust followed, so that there would not be any great amount of fine dust ground up constantly by the passing of the workmen and horses, and things of that kind. But this was a new coal face being moved forward, and therefore the débris whatever it may be that was scattered upon the floor would be quite fresh, and certainly would not be ground up in the way you would apprehend the dust would be ordinarily in a travelling way.

5783. But if it were not fine dust, and not ground up so as to be very fine, it would be less liable to explosion than fine dust would have been?—But allow me to point out that the dust certainly elongated the flame of the blown-out shot and was exactly similar in character to the dust at the point where the explosion ceased, so far as I am informed.

5784. But I understand that the very fine dust is much more explosive, and gives rise to a much more violent flame than the coarse dust, and if that be the case the flame in the present instance might not have been of sufficient force and violence to go very far?—Of course the coal dust that was on the whole of this length of roadway and on the face of the coal where the men were working the coal, the coal dust would be similar in character the whole face through, and I fail to see if the coal dust was sufficiently fine to carry the flame 30 or 40 yards, as the case may be, why it should not carry the flame 100 or 150 yards, provided the theory which is advanced by some gentlemen is correct.

5785. The theory does not amount to a positive statement that in all cases it *would* go far, but only that it *might* go far?—But against that theory I have to again draw your attention to the fact that this is an isolated instance; that in this instance it did stop at certainly the outside 50 yards; that that is an instance out of millions of shots that have been fired in that and other collieries for many years past, and against that one instance, we have to show the fact with reference to the Forest of Dean itself, that we can never trace the slightest explosion whatever.

5786. That would go to show, would it not, that the risk was slight, but it would not go to show that there was no risk, because one affirmative is more powerful than a great number of negatives?—Of course, my own opinion is that the fact of the blown-out shot flame being elongated to a limited extent is very different from the fact that some gentlemen seek to establish, that coal dust itself will cause an explosion which would extend over a whole colliery. I should like again to refer to the experiments that have been so exhaustively made by Professor Abel, the Prussian, and the other gentlemen, where they show that the utmost limit that coal dust alone would carry a flame, I think, is 70 feet. Their experiments have shown that a blown-out shot flame with coal dust suspended in the air in a very large quantity, of an explosive mixture, and in the complete absence of gas, would undoubtedly elongate the flame of the blown-out shot, but that to such a limited extent, that in their opinion the coal dust was not to be considered as dangerous, and causing explosions in mines.

5787. You are acquainted, are you not, with the Prussian experiments; you have followed them?—The Prussian experiments were made some years ago, I am afraid.

5788. In that case the gallery was nearly 200 feet long, was it not?—I am sorry my memory will not carry me as to that particularly, but I have no doubt that it was as you state.

5789. You may take it that it was something of the kind. Are you aware that on one occasion an explosion was brought about in that gallery of the coal dust alone, which not only carried the flame to the end of the gallery, but blew out some heavy trollies at the end of the gallery, which shows that even at the end of the explosion there was a tremendous force?—Are you referring to the experiments of the Prussian Commission in 1884?

5790. I think so?—Well, I cannot say, but I can state what the words of the Commissioners themselves were: "In complete absence of fire-damp" (which is our condition essentially) "the elongation or propagation of the flame is generally of limited extent, however far dust deposits may extend, 70 feet being the maximum." Those are their own words taken from the report.

5791. Well, I will only ask one more question, I will put it that if in the Radstock Pit the explosion continued for 50 yards, do you think it would be impossible for it to continue beyond?—That is my opinion, so far as I am informed at the present time from experience.

5792. What is the difference between the circumstances which allow of it being carried 50 yards, and prevent it being carried 100 yards; why should the same circumstances which carry it on 50 yards, not carry it on 100 yards?—Of course it must be apparent that when the blown-out shot liberates itself, instead of doing the work which it ought to do, the flame that is given off at the moment of explosion, must be a fierce one, and necessarily there must be a great amount of heat at that particular moment; that great

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amount of heat would undoubtedly, under favourable conditions, ignite certain classes of coal dust; and the heat would spend itself by the time it got a certain distance, more or less, according to circumstances.

5793. Yes, but the heat of the blown-out shot would not reach 50 yards, and could not account for the ignition of the coal dust 50 yards off. The heat of the blown-out shot no doubt accounts amply for the ignition of the coal in the immediate vicinity?—Yes.

5794. But the coal dust at a distance, say, of 30 yards, must have been ignited by the heat of the coal dust behind it; and if that be so, why should not in its turn, the coal dust 30 yards off, ignite the coal dust of 50 yards, and the 50 yards ignite the coal dust of 70 yards, and so on?—Of course, as you very properly say, the flame from the blown-out shot undoubtedly ignites the coal dust in the first instance; the heat from the blown-out shot would carry itself necessarily before it was spent, some distance, much further than the flame would carry; and my point is this, that the coal dust itself in the entire absence of gas (such as are the conditions existent in the collieries of which I have experience) is not a sufficiently explosive element to carry the flame to any appreciable extent apart from an outside element which is brought in to help such as would be in the case of a blown-out shot.

5795. You have been asked, I think, to represent the views of the colliery managers generally in your district, have you not?—I have.

5796. Have you any resolution from them?—I have a copy which has been sent to me. I do not know whether a copy has been forwarded to the secretary of the Commission.

5797. Will you state what their views are?—Shall I read the whole of the document?

5798. In the first place, what do they represent?—If I read the document it will explain the whole thing.

5799. Will you do so if you please?—"A general "meeting of the managers of the Somersetshire, "Bristol, and Dean Forest collieries, was held this "day" (on the 15th of March last), "for the purpose of "considering the question of coal dust in the non-fiery "seams of these collieries, and Mr. W. N. Atkinson's "report thereon, and the following resolutions were "unanimously adopted. (*a.*) The dust in the non-"fiery seams of Somersetshire, Bristol, and Dean "Forest will not *per se* cause an explosion, and has "never been known to explode. (*b.*) If any experi-"ments are made with the dust from these seams, "those conditions should approximate as closely as "possible to the natural conditions of the workings of "the collieries from which the dust is taken. (*c.*) One "or two managers or mining engineers, nominated by "the managers of the above-named districts, should "be present during such experiments. That "Mr. J. McMurtrie and Mr. Frank Brain be em-"powered to represent the managers of the above-"named districts in giving their evidence before the "Royal Commission, and that copies of these "resolutions be sent to them.—Donald M. D. Stuart, "Chairman."

5800. I suppose then that you would say, and these gentlemen would agree with you, that the ignition of coal dust in the Radstock Pit was not an explosion?—It was not an explosion.

5801. At the same time, I suppose the ignition of coal dust under these circumstances might be the cause of serious danger?—Which we think is amply met by the present law.

5802. By what provision in the present law do you think that danger is met?—The general rules I believe, I have not the Act with me, but it is the set of clauses referring to coal dust in mines.

5803. (*Sir William Lewis.*) You mean as to the watering?—As to the watering.

5804. And the condition of the place before the shot is fired?—And the condition of the place before the shot is fired.

5805. (*Chairman.*) You think watering is desirable, although the danger is so slight?—I certainly do not, so far as the Forest of Dean is concerned.

5806. But you referred to the general rules, and I understood you to suggest that they ought to be carried out?—Not put in force. Oh, no! There is already sufficient power given to the Government inspectors if they deem it necessary to enforce the regulations, which would be ample in all cases that have come before my notice so far as regards this district.

5807. Yes, but then do you mean that you consider that in those districts it is not necessary to put those regulations in force?—I think not.

5808. I understand you to say that you would take no extra precautions of any kind against coal dust in this district?—So far as the Forest of Dean is concerned, decidedly not.

5809. In the case to which I have been calling your attention a man was burnt; he might have been killed by the same explosion might he not?—Well, of course, I could not say not knowing the full circumstances.

5810. The mere fact that he was burnt is a proof that his life was more or less in danger?—Certainly. He was injured, I suppose.

5811. Would not you consider in such a case as that, it would be desirable to take the precautions indicated by the general rule?—I understand as a matter of fact, that the Government inspector has not ordered these precautions to be taken in that particular instance.

5812. Yes, but I am asking for your own opinion?—I think not.

5813. You think it would be unnecessary. Do you think that any precautions are necessary in respect of shot-firing in your district?—I think not; none other than we are at present observing.

5814. What precautions do you observe?—We take every possible care that the proper placing, of course, of the shot holes is enforced upon the men.

5815. You do not consider it necessary to prohibit the use of gunpowder in your district?—Certainly not.

5816. Do you use flameless explosives?—None whatever.

5817. What is the advantage of using inflammable explosives, is it cheaper than non-inflammable?—Somewhat cheaper.

5818. Is that the only advantage, or is there any other advantage in the working of the mine?—Of course, as has been said, there is a great difference of opinion but under certain circumstances, gunpowder may do its work better than other explosives.

5819. I think you have some system of your own to which you have given special attention in connexion with blasting?—Yes. I have made quite a study of blasting, with a view to supplant the time fuse by an electric fuse, and the system has been very largely adopted in many parts of the country. I think I may say it has been found to answer admirably.

5820. What is the advantage of it?—There is no tendency in the first place to miss shots, miss fire; occasionally the time fuse hangs fire as we call it, and it has been known to go off after hanging fire, a considerable time afterwards. Then, further, of course, the flame of the lamp has to be used to ignite the time fuse, which introduces a further element of risk; and further, the time fuse has been known to flame under certain conditions which, of course, in gassy mines would be dangerous. When electricity is used there is no possibility of a flame whatever; it is simply an electric spark passing from a small machine along an insulated wire right into the heart of the explosive and firing the detonating cap, which would be fixed near the explosive.

5821. I suppose such a system as that is more necessary in fiery mines than in your mine?—It refers entirely to fiery mines. There is no necessity for it whatever in our mines.

5822. Is there any other matter that you wish to speak about?—No, I cannot think of anything at present.

5823. (*Professor Dixon.*) Do you pass a spark by the detonator in your apparatus, or heat a small piece of platinum wire?—In some instances we heat a small piece of platinum wire, and in other instances we heat what answers to the platinum wire—a small quantity of explosive compound between the two wires of the battery.

5824. You pass a spark?—It would not be a spark because the explosive would have sufficient conductivity

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to allow a current of electricity to pass through, and yet not conductive enough to allow that current to pass through without heating.

5825. That was the reason I asked the question. I thought it would be dangerous to have a spark passing. You quoted just now the conclusions by Mr. Hilt, principally with reference to the experiments at Saarbrucken in 1884. Were not these the words you quoted "The presence of coal dust in more or less "abundance in the immediate vicinity of the working "face gives rise to more or less considerable elongation "of the flame projected by a blown-out shot whether "small quantities of fire-damp be present in the "surrounding air or not?"—Are those words you are quoting taken from the Accidents in Mines Commission Report?

5826. These words are quoted from that report; are not they the same words that you quoted?—The words are different from those I read: "In complete absence of "fire-damp the elongation or propagation of the flame is "generally of limited extent, however far dust deposits "may extend, 70 feet being the maximum"?—Quite so.

5827. I have got that. I will read the second clause. "In the complete absence of fire-damp the elongation or "propagation of flame is generally of limited extent"? —Quite so.

5828. "However far the deposits of dust may extend in the mine-ways"?—That is so.

5829. You quoted that sentence just now and you said that the Prussian Commission came to this definite conclusion, I understood you?—Yes. I understood that to be the judgment of the Commission.

5830. I ask you then to read the next paragraph in the conclusions of the Prussian Commission, which says, "There are, however, certain descriptions of coal dust "which, if ignited by a blown-out shot, will not only con- "tinue to carry on the flame even to distances extending "considerably beyond the confines of the dust deposits, "but will also give rise to explosive phenomena or "results in the complete absence of any trace of fire- "damp, which in character and effects are similar to "those produced with some other dust in air containing "7 per cent. of fire-damp." That is the next paragraph in fact in the conclusions of the Prussian Commission. Have you taken that paragraph into consideration in giving your statement just now to the Commission?—I base my remarks mainly upon a further view they gave. They say a considerable distance (they do not mention the distance), but I have it here if I have copied it correctly, from the Accidents in Mines Report, that 70 feet was the maximum at which flame was found.

5831. I think that must be an error. I have it here in one case where dust was strewn for a length of 130 feet. "The flame was projected 16 feet beyond the "length, 167 feet of the gallery, or at least 185 feet in "all." That is from the Prussian Commission?—I accept the correction.

5832. You have not considered that?—No. I am still at a loss to know where I got this 70 feet as being the maximum.

5833. That must be an error; the gallery in the Prussian Commission was 167 feet long?—Yes.

5834. And the flame blew out at the end, 16 feet beyond it?—In the entire absence of fire-damp?

5835. Yes. Would you in such a case as that state that that was an explosion or merely an elongation of the flame?—I think those conditions would almost carry out the suggestion referred to by Mr. Chamberlain, at Radstock. Fifty yards, I think, was the total number of yards, and that would be 150 feet, and this 167 feet would be practically the same.

5836. Would you call that an explosion or an elongation of the flame?—An elongation of the flame, aided by the coal dust.

5837. You have not visited the pit at Radstock, have you?—No.

5838. Do you know whether the flame was elongated in the direction in which the shot blew out, or in the opposite direction; do you know the direction with regard to the long wall?—I have been informed that it was not in the direction the shot was placed.

5839. No, it was quite opposite; the flame went opposite to that in which the gas blew out?—I think it was in the direction of the air current.

5840. You have not visited the pits, so that you could not say, whether they are dusty or not?—I could not.

5841. In your own pits are they dusty along the long wall?—In my particular colliery, not.

5842. You work long wall, do you not?—Yes.

5843. Are the roads dusty?—Some of them are; but I should not call mine a dry and dusty mine.

5844. Is it damp?—It is somewhat damp.

5845. Have you occasion to fire shots in the roadways?—Occasionally.

5846. There the dust is damp?—It is naturally somewhat damp.

5847. So that you have not had the condition in your own mine which is referred to by Mr. Atkinson as a dry and dusty mine?—Not to the full extent, perhaps.

5848. (*Mr. Fenwick.*) I think you, in answer to the Chairman, seemed to attach some importance to the suggestion that the prolongation of the flame would have some relation to the strength of the charge; are you accustomed to fire shots in the roof in the stone for roadways?—In the roadways, yes.

5849. Are any of those shots at times fired near to the working face?—Yes.

5850. Would there be any quantity of dust near to where those shots were being fired?—In this particular instance, at Radstock, it was close to the working face; it was at the working face.

5851. It was in the coal?—Yes.

5852. Radstock presented an instance of working the long wall?—Yes. We also work the long wall.

5853. And the air current was travelling along the face; was it a square face?—It was somewhat of a semicircle. The face would stand round from the heading.

5854. You seem to doubt that the prolongation of the flame may be carried to any very considerable extent, but, following up the question put to you by the Chairman, would you consider that the flame from the dust once commenced by the flame emanating from the blown-out shot would gather in a gallery that is strewed with finely divided coal dust, would gather up fresh fuel as it comes, and then intensify the heat?—In the districts with which I am associated my opinion is that it would decidedly not.

5855. But in the case of the Radstock, do you think that it would have a tendency to do so there?—I think decidedly not; and that incident mentioned has corroborated my opinion.

5856. What are the depths of the collieries working in the Dean Forest?—200 and 300 yards.

5857. (*Sir William Lewis.*) Have you ever seen a blown-out shot?—Well, I have seen one or two, but it is very occasionally we have them, and, of course, I am not constantly in the workings.

5858. But would you then say that the effect of a blown-out shot would be limited to five or six feet, as you did in answer to the Chairman?—Decidedly not. I think I qualified that. I intended to say that it depended so much upon circumstances.

5859. But you said that the flame would be only five or six feet. Do you speak from what you have observed, or from what has been represented to you by those who have seen a blown-out shot?—More from what has been represented to me than from my own experience.

5860. You have open lights in the Forest of Dean?—We use candles and lamps entirely.

5861. At Radstock do you know what was used?—I believe partly lamps and partly open lights.

5862. Do you know whether gas has ever been seen in any of the measures that are being worked in those pits at Radstock?—In some of the measures I believe gas has been found.

5863. But you have never seen any gas in the Forest mines?—Never.

5864. Could you tell us whether there was any indication of disturbance at the point where this man was burnt, or was it simply an inflammation up to that point? Were the timbers knocked out, or was there any indication of a disturbance extending as far back as

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where the man was burnt?—I think I am right in saying that there was little, if any, disturbance whatever.

5865. Do you suggest that the shot blew out, and that the flame in connexion with it was carried with the air in the direction of the current, that it inflamed the dust and continued to burn up to where this man was, and nothing else?—I think so

5866. There was no force whatever?—Force—yes, because, as I understand the position of the shot, it was near to a doorway which was directly facing the point at which the shot was put in.

5867. Would you mind making a sketch showing the position of the face and the direction in which the shot blew out?—My information is subject to correction. I can only do it from memory and from what I have been told. (*The witness drew a sketch and proceeded to describe it.*) *This* represents the face of the coal; the air current was travelling up the face. *There* was a doorway, I cannot say whether it was 14 or 15 yards back from the face, but it was somewhere *here*, opening this way.

5868. Was it towards the face?—Yes, towards the face; the direction of the shot, I cannot say, but I fancy it was put in a little like *that*.

5869. Then it was almost at right angles with the face at that point?—Yes.

5870. At all events at right angles with the current?—Yes; the man, I believe, that was burnt was somewhere in bye-side; there were other men along here, a very few yards away at the other side of the door. The explosion extended from *this* point to somewhere *here*, I cannot say exactly where, and then it died out entirely. What I meant in referring to the blowing out of the shot would be the fact that necessarily with the large explosion such as would happen in this instance (because I understand that the charge was entirely blown out and failed to do its work) there was very considerable flame; the air *here* would naturally be compressed in that very short distance, and therefore that would add to the extent of the explosion in carrying it around that face. That would necessarily be the only outlet unless it went against the current which would be the line of more resistance. The line of least resistance would be to pass up the coal face in the direction of the air current.

5871. Do you suggest that this was the line of least resistance when you have an opening *here* nearly opposite where the shot blew out, and simply by the blowing down of this door that would be the direction by which the force of the explosion would be naturally expected?—Yes.

5872. Was that so or not?—I say that my opinion would be that the line of least resistance would be the open face rather than blowing down the doorway opposite the shot.

5873. The line of least resistance at right angles with the actual direction of the shot hole?—Under the circumstances which I state the door was not injured at all. Men working along here never knew that an explosion, if it might be called an explosion, had happened.

5874. Does not that go directly against your theory, and is it not entirely in favour of dust being the cause of the explosion. Once created and carried along with the current this way, would you not have expected to have found indications immediately opposite and in the direction of the blown-out shot, instead of finding it at right angles with the blown-out shot, and carried along *here* for 40 yards?—As I before remarked, I think that the flame from the blown-out shot compressed the air here, raised a cloud of dust, and that cloud of dust was set on fire and went with the force of the air current along the face.

5875. Would not you expect that door to be blown out and find indications all the way down the heading? You have told us that the shot blew out and it must have been a pretty severe concussion?—Yes.

5876. And you would expect indications of disturbance, to say the least of it, immediately opposite and in the direction in which the shot was blown out?—I think that the door—it was not a brattice, it was a strong door—being placed at that point, so nearly to the face, caused the compression of the air as I said, and the line of least resistance was the coal face, and it passed along *there*.

5877. In order to have a compression the door must be of greater strength than the force exerted by the blown-out shot?—Decidedly.

5878. Then the force must have been there a slight one if a 6-foot door would resist it?—Some yards away, 15 yards away.

5879. But in the direction and almost opposite to the blown-out shot?—That is my opinion.

5880. Following that point you simply suggest that the flame given off by this blown-out shot inflamed a quantity of dust at this point that was carried by the current and continued to inflame the dust up to 30 or 40 yards and there it spent itself?—That is so.

5881. Is that what you would have expected if you had similar circumstances, say in the Forest? Would you have expected that same result?—Of course, it is a most extraordinary incident. We have never had such an incident, so far as I can gather, in the Forest.

5882. You do not know the difference between the Forest and this place sufficiently well to give any opinion upon that point?—No, I could not.

5883. At all events, assuming that dust will not initiate an explosion, it is desirable, to say the least of it, that some arrangement should be made by which such accidents should be prevented from blown-out shots. You would go to that extent, would you not?—If they were occurring in the Forest of Dean, I should say so.

5884. Yes, but occurring anywhere. This would indicate that there is a danger arising from having blown-out shots where dust does exist in the face of the mine?—A very limited danger.

5885. But still a danger?—Oh, yes.

5886. With that knowledge you are still of opinion that if the provisions of the present Act of Parliament are perfectly carried out there is no necessity for further legislation?—I do not say that generally. I am only speaking with reference to the characteristics of our own district.

5887. Then you do not give us any opinion upon mines in general?—Certainly not. I prefer not entering into that.

5888. You have had no experience in our South Wales collieries?—None whatever.

5889. And you do not find it necessary to put in force the provisions of the Mines Act?—We do not with reference to this particularly.

5890. And you do not find it necessary to water?—No.

5891. Nor do you find it necessary to clear the dust before firing the shots?—No. I wish it to be distinctly understood I give my opinion only with reference to the Forest of Dean.

5892. Are you in the habit of setting off more than one shot at a time in the Forest?—Not usually.

5893. Would you consider that attended with danger even in the Forest?—We have never considered it so; we should do so if we required it.

5894. From your experience in shot-firing, would you think it possible with one shot raising the dust that the next shot afterwards might inflame it to such an extent as to be the cause of a serious accident?—I do not think so in the Forest of Dean.

5895. (*Lord Rayleigh.*) I do not quite understand the distinction that you seem to draw between the explosion of coal dust and the mere inflammation of coal dust. Can you explain that further?—I am afraid I am somewhat at a loss to know how to explain it further.

5896. Do you think there is any distinction?—What I wish to convey is, that the coal dust under certain conditions may help to feed the flame given off by the blown-out shot, but only to a limited extent.

5897. Take this case which has been mentioned at Radstock in which, in your phrase, the flame of the blown-out shot was elongated by the aid of coal dust up to about 50 yards; supposing that that elongation had occurred to 500 yards instead of 50 yards, would you still have considered it an elongation of the original flame?—Certainly not. I should say that is an explosion of the coal dust.

5898. Therefore what you call an explosion would depend upon the extent to which the inflammation extends?—Yes, because in the second instance it is quite apparent that the flame of the blown-out shot would have been utterly exhausted long before it had gone 50 yards, much less 500 yards, and therefore the coal dust itself must have been sufficiently dangerous to have carried on that explosion the distance you name.

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5899. Does not that amount to saying that there is no real difference between the explosion and the inflammation. If the inflammation occurred on a sufficiently large scale you would call it an explosion, and if it were on a small scale it would be inflammation?—I hardly agree with you.

5900. How would you put it?—I would say that the very limited extent to which coal dust in the entire absence of gas has up to the present time been shown to carry a flame is not sufficient to justify the conclusion being come to that coal dust of itself, and of itself alone, will produce an explosion such as the one you have now drawn my attention to as an example.

5901. In spite of the fact that the inflammation extended in this case to 50 yards you think it is quite safe to assume that it could not be spread to 100 or 200 yards?—Speaking with regard to the Forest of Dean we have never had one to the extent of 50 yards even; and even with the experience before me of the one you name extending to 50 yards, I do not think even with that experience that is sufficient to alter my opinion.

5902. Would not you go so far as to admit that it is rather a nice matter whether or not an explosion, in the full sense of the term, will result when the flame can extend to so great a distance as 50 yards from the source?—If that be so, I ask why in districts such as this, where in all our collieries, some of which have been reported upon by Mr. Atkinson as being dry and dusty, where we are firing thousands of gunpowder shots in the year, why is it that we have never had the slightest experience of an explosion?

5903. But is not it a fact that your mines are not dry and dusty?—Some of the mines were reported by Mr. Atkinson as being dry and dusty, and others as not being so.

5904. (*Sir William Lewis.*) I observe in this memorandum, which is signed by Mr. Stuart, as chairman of this meeting, that the opinion was intended to be conveyed with reference to the "non-fiery seams" of Somerset, Bristol, and the Dean Forest. I would infer from that that the same conclusions would not hold good with respect to the fiery seams in that coalfield?—That is so. On that point there is a great difference of opinion amongst these gentlemen.

5905. I think that is important. Now, are you in a position to speak for those districts with reference to the fiery portion of the strata in Somersetshire, Bristol, and the Dean Forest?—I am not.

5906. You are aware that in Radstock and other collieries some of the seams are highly charged with gas?—I believe so.

5907. And we are not to take your opinion as expressed here to-day as applicable to those districts?—Not the districts charged with gas, certainly. Primarily I represent the Forest of Dean, in which there is an entire absence of gas.

5908. My attention was only called to this after I saw this document?—Certainly, the mines in the Bristol and Somerset districts, so far as the mines in these districts are concerned, that have no gas in them.

5909. But you would draw a distinction, and a very important one, between the fiery seams and the non-fiery seams?—I should, a very important one.

5910. (*Chairman.*) I omitted to ask you a question or two in regard to the resolution which you have read, and which refers to possible experiments. In this resolution it is said those experiments should be approximated as nearly as possible to the natural conditions existing in the collieries. Will you explain what you consider would be an approximation in an experiment to the natural conditions of the colliery? How do you think that that approximation should be secured?—I am afraid I am hardly competent to suggest to you gentlemen how to do that.

5911. I assume the matter was discussed by the meeting of managers?—Well, we arrived at no definite conclusion in that matter. I simply give it as an expression of our opinion that the best possible form for those experiments should be adopted having that idea in view. I may say, speaking personally, that it has struck me that it would not be difficult to build up on the surface a chamber corresponding to a roadway, and a coal face such as we should have in the Radstock district or in our own district, and to place on the sides of that chamber dust taken from our various pits, and thus the experiments could be conducted in the chamber with the dust taken from our collieries.

5912. What size should the gallery be?—I should put it as an exact *fac simile* of the roadways in the mine.

5913. But the roadways in mines differ very materially especially in mines in different parts of the country?—Well, I think it would be perhaps not unwise to take as a model the special district that has been referred to this morning in the Radstock Coalpit.

5914. But supposing we were to take that, do you imagine that that would satisfy persons in the Lancashire coal district or in the Scotch coal district?—I could not say with reference to those other districts, but only with reference to our district.

5915. In order to have a satisfactory experiment are we to have an exact model of every mine or of the mines in every district?—Certainly not.

5916. What I want to know is, of course, what are the conditions which you regard as imperative. For instance, what ought to be the length of the gallery?—As long as you can possibly get it, the longer the better.

5917. What would you consider a satisfactory length, a conclusive length?—If it could be got, say 400 or 500 yards.

5918. And what size; what would be the size of the roadway of which you speak?—The ordinary roadway would possibly be 6 feet by 7 feet perhaps.

5919. Are your managers determined to receive no experiment as satisfactory which is not carried out in a gallery 400 or 500 yards long on the surface and 6 feet by 7 feet in size?—Allow me to say, what I think I have already stated, that we arrived at no conclusion as to the final directions which the experiments should take, and you pressed me still further, and I then ventured to give a personal expression of opinion, which has not been considered at all by the managers as a body. I do not think for a moment that our managers would not be satisfied with whatever the Commission thought would be a satisfactory chamber for such a purpose.

5920. I understand then that in passing this resolution the matter was not discussed in any detail?—Not at all. We desire to approximate as nearly as possible to the natural conditions of the mine.

5921. (*Sir William Lewis.*) And in order to satisfy you, you would require that experiments should be made with dust, say from the Dean Forest, a certain set of experiments from the Bristol coal fields, with other experiments from Somerset and from the various other coal fields?—Yes, those coal fields with which we are associated.

5922. And without that you would not be satisfied that dust can initiate an explosion in a mine?—Certainly not. We are strongly of opinion that with regard to our special district we cannot get an explosion in a mine.

The witness withdrew.

Mr. William Walker Hood called and examined.

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5923. (*Chairman.*) You are the general manager of the Glamorgan Coal Company?—I am.

5924. Have you given any attention to the question of the action of coal dust in mines explosions?—Yes, I have for a number of years, in fact ever since Mr. Galloway carried out his experiments at Llwynypia.

5925. What conclusion have you arrived at on the subject?—That coal dust is inflammable without the presence of gas, other than that contained in itself.

5926. I suppose in order to set up the inflammation there must be something in the nature of an explosion?—No, not necessarily.

5927. Do you think that it would explode or inflame by simple contact with the heat?—Yes.

5928. With even an open candle?—No, I do not think that a candle has sufficient flame to do it.

5929. What are the ways in which you think that an explosion might be initiated?—Well, if I can give an

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example, the cleanings of the mill where we prepare the coal for coking, that is to say, a very fine flowery coal, when that is thrown into a coke oven the bricks of which are at a dull red heat you will find that the dust ignites or explodes, and the flame comes out of the oven for a distance of 6 or 8 feet.

5930. There must be, in your opinion, a very considerable body of heat in order to ignite the coal dust?—Yes, there must.

5931. Do you think that a blown-out shot is sufficient for the purpose?—Yes, a blown-out shot of gunpowder.

5932. Do you think that that would be sufficient to set up an explosion of coal dust?—I think so.

5933. Without gas?—Without gas.

5934. And once set up do you think it would be continued?—Undoubtedly.

5935. Indefinitely?—Indefinitely, as long as dust exists.

5936. Have you had any experience in explosions which have confirmed your views?—Yes.

5937. Will you state them?—The Pen-y-Graig, or Naval Colliery, that was a very dry and dusty mine. I am of opinion that that occurred by a gunpowder shot firing some gas, which ignited the dust and carried the flame into every portion of the colliery. It was fiercer on the main travelling roads where the areas were greater and the dust finer.

5938. You do not think that the continuance of the explosion could be accounted for by gas?—No, certainly not.

5939. Why not?—Because there could not be any gas at the bottom of the down-cast shaft with such a current of air passing; and blowers, in my experience, although they come suddenly, do not go away suddenly.

5940. You would have expected to find traces afterwards if there had been blowers?—We should have expected to see gas in the workings. With the diminished quantity of air travelling after that explosion, due to the ventilating apparatus being damaged, the cap on the safety lamp was barely half an inch, that is, at the bottom of the upcast shaft.

5941. Are there any other instances which you wish to give?—Well, at the National Colliery there was an explosion in 1887; the spread of that explosion was stopped by water on the roadways at the bottom of the downcast and also at the bottom of the upcast shafts.

5942. You think that was a dust explosion?—Certainly.

5943. Holding this opinion, I suppose you consider that the presence of dust is extremely dangerous if precautions are not taken against it?—Yes, it is.

5944. It might cause an explosion, and it would be likely to increase the effects of an explosion?—Yes.

5945. Do you think it necessary to take any additional precautions to those which are indicated in the general rules?—I do not think that it is necessary.

5946. Do you think these precautions are sufficient?—Yes

5947. That is to say, the removal of the dust?—At the parts where shots are fired.

5948. Where you fire a shot and, also, in the main roads where dust accumulates?—Yes.

5949. And the watering of the dust?—And the watering of the dust.

5950. But you think that these precautions ought to be observed in all dusty mines?—I do not think that exactly. I think that if 20 yards is watered round about where a shot is to be fired it is not necessary to water all the roads, but I do it for the comfort of the men in the mine.

5951. Do you remove the dust?—No, we water it. I do not think that it can be removed sufficiently.

5952. For the purposes of safety, all that you think necessary is to water where the shot is fired?—Yes.

5953. What is the practice generally adopted in the South Wales coalfield?—Most of the main roads are watered.

5954. How?—By means of tanks and by means of jets.

5955. What mode do you adopt yourself?—Jets and tanks.

5956. Both?—Yes.

5957. Which do you prefer?—Jets.

5958. Is the jet system a system of spray?—Yes.

5959. Do you use the system invented by Mr. Martin?—No, I do not; but it is undoubtedly the best spray.

5960. He uses compressed air?—Yes.

5961. Why do not you use that if it is the best?—Because I get very nearly the same result by pressure.

5962. By pressure upon the water?—By pressure upon the water.

5963. Without introducing the air into it?—Without introducing the air into it.

5964. I think Mr. Martin contends that with the air the spray is much finer and extends further, and, altogether, that it has a much better result?—Yes, it has a little better result.

5965. Will you explain the system of water spray?—I put a spray about every 40 yards in the main roads; but even that system of watering is not perfect in dry and frosty weather, in fact, it is impossible to get up the degree of humidity to thoroughly saturate the air with moisture in frosty weather.

5966. Then you can do nothing in frosty weather?—Oh, yes, we can do it partially, but you cannot saturate the air with moisture.

5967. Have you got any diagrams to show that?—I have got diagrams to show it in three different stages, that is to say, the humidity in the air when the jets are idle, and another one showing the humidity in the air when the jets are going, and the surface temperature nearly normal, and the next one in frosty weather. (*The witness then described some hygrometrical tables.*)

Referring to Diagram No. 1 of hygrometrical readings of the Penrhys district, the witness stated that the water sprays had been idle, and had not been going for four days previous to those readings being taken; and that all the way round the workings 80 was about the highest humidity that was obtained.

5968. (*Lord Rayleigh.*) Do you mean 80 per cent. is the possible amount of moisture in the air?—Yes, under those conditions.

5969. Does Diagram No. 1 refer to a day on which the conditions were difficult to secure moisture?—The weather was cold and foggy, with 88 per cent. of humidity in the air on the surface.

5970. (*Chairman.*) I see the difference between the two bulbs is four degrees?—Yes.

5971. Part of the roads were damp from the watering having been previously done?—The roads would not be absolutely dry on that day. (*The witness described Diagram No. 2.*)

5972. Now then, will you explain what it was when the sprays were at work?—That was the most favourable day for it was raining heavily on the surface. The dry bulb was 50 and the wet bulb 49½. I do not show the readings at the surface on the diagram.

5973. And here the two bulbs seem to have been the same, or nearly the same all through?—Yes, excepting the face, where it dries up a little, there is about half a degree of difference between the two bulbs.

5974. Is it practically complete saturation?—It is practically complete saturation. I do not want the air to be completely saturated where the men are working.

5975. (*Professor Dixon.*) Do the men find it unpleasant?—Yes, you cannot get complete saturation where the colliers are working, but the jets are always full on, both in the intake and the return. Inside, of course, we cannot keep the jets going.

5976. How long do you work them?—In the roads where men are working we work them for two hours at a time, and 24 hours in the two main roads.

5977. (*Sir William Lewis.*) Have you those jets in your returns?—Yes, and the intakes. (*Witness described Diagram No. 3.*)

5978. (*Chairman.*) Now, with reference to the third diagram, is it taken in the case of frosty weather?—

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Yes, we get a temperature of 31° at the surface, and it is much colder away from the pit top as it is surrounded by coke ovens and boilers.

5979. And this diagram represents the state of things when the sprays are on?—When the sprays are at full work with frosty weather on the surface, it is impossible to saturate the atmosphere underground.

5980. And the general result seems to be a difference of two degrees between the two bulbs?—Yes, we do not get higher than 91 of humidity, and we cannot get it up higher.

5981. (*Lord Rayleigh.*) What degree of humidity do you consider desirable?—For the main roads I like to have it up to 100 degrees of humidity, but I should not have it up to that in the working place as it is not a pleasant atmosphere to work in; and there it dries of its own accord.

5982. (*Professor Dixon.*) Does not that keep the dust damped between 90 per cent. and 100 degrees of humidity?—It cannot wet the dust because it cannot deposit, on account of the temperature still rising.

5983. It will not deposit because where the dust is damp, it does not dry quickly?—It does not; if you can get the main roads well saturated it takes a much longer time to dry up the other roads around the faces of the workings.

5984. (*Chairman.*) Do you consider this system effective for this purpose?—Nearly so; but the only effective way of watering is watering by steam, that is to say, start at the pit bottom at a temperature of 85° or 90°, and let the air cool as it goes round, but it is impracticable. The men cannot work, it brings down the top and lifts the bottom. I tried it once and it cost our Company several hundred pounds to repair the damage done.

5985. You do not consider that it is feasible?—No, because in practice it cannot be done.

5986. Do you consider the system of working by spray as good as any system of damping down can be?—Yes, as far as any that I have seen, as long as there is pressure to secure a good division of the water. The average is 330 lbs. to the square inch.

5987. And you do it to make it better for the men?—For the comfort of the men.

5988. But incidentally, under a system of this kind it does remove all danger of explosion from coal dust?—It does remove the danger, and in my opinion an explosion cannot spread along roads that are thoroughly damped.

5989. But you would not think it advisable to adopt it solely for the purpose of precaution?—I think I would.

5990. Do you think that any precautions are necessary with regard to shot-firing?—None other than what are already taken.

5991. Do you use gunpowder?—No, not in dusty mines.

5992. Do you use flameless explosives?—As nearly flameless as possible.

5993. What explosive do you use?—Gelatine.

5994. Have you tried ammonite?—No I am going to try it next week. I have tried all the others.

5995. Of those you have tried you prefer gelatine?—Yes; but it must be tamped with wet peat, and then it is practically flameless.

5996. Are there any other points which you would like to allude to?—Yes. I may mention this. I see Mr. Stokes mentioned the same roads that I have referred to in his evidence—about dust that could be taken from the pipes, and he thought there was enough dust to carry on an explosion. I do not think so myself, and since then I have had the dust analysed for moisture. The natural moisture in that coal is ·80 per cent. and the moisture in the dust so found on this plane was 1·84 per cent., and I do not think that that would explode or ignite, the quantity is too small.

5997. (*Sir William Lewis.*) You referred to the effect arising from having fine dust put into a coke oven?—Yes.

5998. My question is whether you said when the flame came out, it came out with any force in the shape of an explosion or simply a large flame?—A large ignition, I should say; not an explosion, just a flame.

5999. It came out with no force nor noise?—No, because it was not confined, the door being open.

6000. Have you ever tried that with the door shut?—No, I have not.

6001. You have not tried the effect to see whether it would blow down the door?—No, I have not, it is so seldom that the thing occurs.

6002. You also mentioned to the Chairman the indications at Pen-y-Graig, the extension of the explosion being entirely due to the dust from the mine. Do you not recollect seeing indications of the effect of the explosion where there was no charred dust at all?—Yes.

6003. In the hard heading?—Yes.

6004. And it had continued through there?—Yes.

6005. Would you suggest that it was continued through there by coal dust or by gas which had been released by the effect of the charred coal dust?—It might certainly be by gas, but I think that it was by coal dust and stone dust combined.

6006. There was no indication along the hard heading, you will admit that?—I admit that.

6007. None whatever?—No.

6008. But still you found the effect of the explosion beyond that, and without any indication whatever between the two points?—Yes.

6009. And you suggest that that was conveyed by the fine coal dust mixed with stone dust?—Yes, all the flame from the upper workings traversing all that distance without anything.

6010. And leaving no trace at all either in the sides or top?—No.

6011. With reference to these watering arrangements, would you consider that it is necessary that it should be conducted generally or only in collieries where a certain quality of coal is worked?—The only place I would apply it to is in collieries where the natural heat is high, in order to lower the temperature to make it more comfortable to work in.

6012. Do you think the quality of the dust has something to do with it?—Yes.

6013. Take collieries in Scotland, I know you are connected with Scotch collieries, would you consider it necessary to have watering arrangements in connexion with those collieries?—Certainly not.

6014. I was not in the room when you were explaining the whole of those diagrams, but I do not quite understand what you resort to in frosty weather where you say that you have a difficulty in getting the necessary amount of humidity?—Well, what I have done is to put a steam jet at the top of the downcast.

6015. Do you not find that that interferes very greatly with your roof and the bottom?—It is a very small jet. We could not do it to any extent.

6016. You raise the temperature to about the normal temperature?—Not so much.

6017. The effect of that is not carried inbye?—No, only a few yards down the shaft.

6018. Then, with respect to your explosive. Are you obliged to use wet peat tamping for gelatine?—No, wet clay, or wet stone dust, but I prefer peat myself, and I use it.

6019. In every case?—In almost every case.

6020. Have you ever seen a flame with gelatine?—Yes.

6021. With ordinary tamping or wet peat?—What would you call ordinary tamping?

6022. Stone dust?—No. I should be satisfied if the stone dust is wet.

6023. Without being wet have you never seen a flame from gelatine with dry stone dust tamping?—Yes, I have; not a big flame, just a small flame that you could see, that is all.

6024. Have you ever witnessed a blown-out shot underground?—Yes, I have; a powder blown-out shot.

6025. To what extent did the flame continue beyond the hole in the case of the particular shot you saw?—It was difficult to say how far it came because I was in the heading that it was fired in, and not standing at right angles to the shot.

6026. It was blowing in the direction in which you were going?—From where I was standing, but I should say 5 or 6 feet only.

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6027. Was that in a place were there was fine dust?—No. In No. 3 seam, which is damp naturally.

6028. With your experience in dealing with very large quantities of steam coal in the Rhondda district, do you think it is necessary to improve any of the arrangements provided for under the present Mines Act?—I think, if the present Mines Act is carried out thoroughly, there is nothing else required.

6029. I take it you are perfectly satisfied without any further experiment with respect to the effect of coal dust?—Yes.

6030. You do not think any more are necessary?—Well, I should like to see experiments with coal dust and different kinds of explosives.

6031. What would be the object of further experiments if you are satisfied that coal dust will initiate an explosion?—I am not satisfied that it would do so with the higher explosives.

6032. That is to say, you want to ascertain to what extent the higher explosives are flameless?—Or will ignite coal dust.

6033. Because given an ignition you believe they can initiate an explosion?—Yes.

6034. (*Mr. Fenwick.*) I think you said that the flame of a candle would be insufficient to ignite coal dust. Would you consider that that answer would apply equally to the flame of a torch?—Coal dust will ignite at a torch, but the dust must be so thick that it would be impossible to live in such an atmosphere.

6035. The explosion that you referred to at Pen-y-Graig, which you said was a dust explosion, I think you said that the shot there was fired into gas; was that so?—There was nothing definite that could be found out. But that was my own impression that the shot had been fired in a heading and that it fired gas there either in front of the shot or behind it.

6036. Which ignited the coal dust?—Which ignited the coal dust.

6037. (*Professor Dixon.*) The watering which you are carrying on in your mine is done by a spray I understand?—Yes, I have got a sample spray if you would like to see one.

6038. What pressure do you work under?—335 lbs. on the square inch on an average.

6039. (*Sir William Lewis.*) What is the velocity of the current?—Eight and nine feet is the average velocity per second. The number of jets depends entirely upon the size of the road and the quantity of the air.

The witness withdrew.

Adjourned *sine die.*

At 23, Great George Street, Westminster.

SIXTEENTH DAY.

Friday, 8th April 1892.

PRESENT:

THE RIGHT HON. JOSEPH CHAMBERLAIN, M.P., CHAIRMAN.

LORD RAYLEIGH.
Sir WILLIAM LEWIS.

Mr. CHARLES FENWICK, M.P.
Professor HAROLD DIXON.

Mr. J. WILSON, *Secretary.*

Mr. J. McMurtrie.

8 April 1892.

Mr. J. McMURTRIE called and examined.

6040. (*Chairman.*) You are a mining engineer, I think?—Yes.

6041. Residing at Radstock?—Yes.

6042. And past President of the South Wales Institute of Civil Engineers?—I am.

6043. What collieries have you managed?—The Radstock Collieries, the property of the late Countess Waldegrave and her trustees.

6044. For how long have you been managing those collieries?—Nearly 30 years.

6045. Will you explain to the Commission the nature of those collieries?—They are collieries consisting of four working pits and employing nearly 900 men. They have two distinct groups of seams: the upper group called The Radstock, which consists of six workable seams, ranging from 1 foot to 2 feet 4 inches in workable thickness; the second group, or Farrington series, consisting of about six seams more of approximately the same thickness, perhaps slightly thicker.

6046. For how long have those seams been working?—The upper group, the Radstock, has been working for 100 years.

6047. Is there any indication of fire-damp there in your opinion?—None whatever. During the whole of those years, as far as we have any record, and certainly within the 30 years that I have known the district, there has been no solitary instance of gas of any kind having been found in these mines.

6048. What is the method of working employed?—Exclusively the long wall system, with continuous faces of great length, there being no hatching-off or anything of that sort, but continuous working faces.

6049. What is the character of the coal?—The coal of the Radstock series is a very hard and compact coal, and in most instances not friable. It produces house and to some extent gas coal, the small coal being used for manufacturing purposes.

6050. This coal does not give off much gas?—It gives off none whatever.

6051. You would not say that these mines were either dry or dusty mines?—I certainly would not, as far as regards the Radstock group. But there are districts here and there where the strata are very dry, and where you find a small amount of dust.

6052. What is the character of the dust?—The dust would be for the most part pure coal dust, but with a certain amount of shale dust mixed with it.

6053. Have you seen, in the Report made by this Commission, the Report made by Mr. W. N. Atkinson?—I have. It is set out in Appendix 11 of the Report I have before me.

6054. Mr. Atkinson, I think, reports that in some cases which he names he found dust which might possibly be a source of danger?—Yes. I think I can quote from the particular part of his report that refers to the mines in question. I think you will find it at page 177, Appendix 11 of the First Report, and his remarks apply to No. 5 pit, near Radstock. There you will find his remarks upon the particular seams I have to do with.

6055. Will you quote the words?—He says with regard to the deeper series—the second series—that "They are the driest workings I found in the Bristol "and Somerset coalfield, and the dust in them appears "pure enough to be capable of causing an explosion if "raised and ignited." And later on he refers to the

Upper or Radstock series, where he says, "Here there "is an old engine plane about 600 yards long, in which "there is much fine coal-dust, moderately dry "(samples taken from timber and floor). If this dust "is dry enough to burn in the air, it is plentiful and "pure enough to cause a dangerous explosion." And further on he says, "From this engine plane to the "working face the road is a horse road, and the dust "very stony."

6056. During the whole time which you have known these pits are you aware of any explosion having taken place?—I have known of none whatever.

6057. Has blasting been going on all the time?—Yes, continuously. There is not so much blasting in the coal itself as in the horse roads adjoining; but these are exclusively formed by blasting, and the number of shots fired annually is very considerable.

6058. Does that apply to the particular places named in Mr. Atkinson's report?—It would, yes; and with regard to the engine plane which he specially describes as being liable to a dangerous explosion, that very engine plane has been enlarged from time to time; refuge holes have been constructed upon it, and a good deal of blasting has necessarily been done during the whole of the 29 years that it has been at work.

6059. When you blast in those places, do you take any precautions?—None whatever.

6060. You do not water the dust?—Never.

6061. And you do not remove the dust?—No.

6062. Now, speaking generally of the seams of the Radstock series, how would you describe them?—As to their being non-fiery, do you mean?

6063. As to their being dry and dusty?—I should say the seams of the Radstock series were not generally dry and dusty, but that there are occasional engine planes and horse roads which are dry and dusty, such as that visited by Mr. Atkinson, which is perhaps the most dry and dusty that we have in the collieries.

6064. Have you formed any estimate of the number of shots which are being fired?—Yes; taking the quantity of powder used as the principal guide, it appears to me that we fire about 20,000 shots annually.

6065. Does that apply to the whole district, or to the particular colliery?—That applies to the particular colliery under my management. During the 30 years I have had charge there must have been at least 600,000 shots fired in the collieries under my care.

6066. (*Sir William Lewis.*) Are those 20,000 shots per annum in the four pits?—Yes, in the four pits.

6067. (*Chairman.*) You have told us you have never known of a coal-dust explosion: have you known any cases in which the flame from a blown-out shot has been extended by coal dust?—I cannot say that I have as regards the Radstock series. It is fair to assume that out of those 600,000 shots there must have been occasionally blown-out shots, but none have been brought to my notice, nor have I ever heard of a lengthened flame, far less of an explosion, having resulted from those shots.

6068. Does that observation hold good of the whole district?—I believe it does. I have never heard of an instance—and these things are generally known where they occur—of a blown-out shot leading even to a lengthened flame in the whole of the Radstock series.

6069. How many pits does that apply to?—Fifteen pits at present. There have been times when more have been at work.

6070. Now going to the second, or the Farrington seams, what have you to say about them?—They have been at work something like 50 years. As regards the seams themselves, they are more friable in their nature and character than the seams of the upper series, and might be called moderately dry and dusty.

6071. Have you yourself had experience of those seams?—I have worked them for six years. Two pits out of the four that I have referred to were deepened to them some six years ago. One of those pits is 299 fathoms in depth, and the other, I believe, is 280 fathoms in depth, and we work two of the lowest seams of that series from those pits.

6072. I think it is to those seams that the quotation which you have already read from Mr. Atkinson's report as to their being the driest workings in the Bristol and Somersetshire coalfields applies?—That is so.

6073. (*Sir William Lewis.*) That is the No. 5 pit?—No. 5 pit, yes.

6074. (*Chairman.*) Have you any experience of other districts—other coalpits?—Yes, I have been professionally engaged in South Wales and the Forest of Dean, and occasionally in other parts of England.

6075. In comparison with those other districts, are the seams of which we are now talking, the Farrington seams, more or less dry and dusty?—I should say they were decidedly more dry and dusty than the Forest of Dean seams, but on the whole not so dry and dusty as the South Wales seams, or the steam coal seams of the Rhondda Valley.

6076. What has your experience been with regard to blasting operations in those seams?—We have carried on extensive blasting operations in them to some small extent in the coal, but to a much larger extent in the roads communicating with the shaft; the number of shots fired during the time that the seams have been opened, which is only a short period, being estimated at about 15,000. We have fired about 15,000 shots altogether since we opened those seams.

6077. Have you ever known any explosion in connexion with those operations?—No, nothing that I should call an explosion. We have had two instances of blown-out shots that my attention has been called to.

6078. I gather from what you say that the blasting operations have chiefly taken place in the roads?—Yes, the majority of them.

6079. And then, I suppose, the dust would not be pure coal dust?—The coal dust often found lodged on timbers is really the purest of the coal dust, and where you do find coal dust in horse roads you only find it of the driest kind. But the dust on the floor would be, as you suggest, more mixed; in fact a considerable portion of it would be shale dust rather than coal dust.

6080. Have you made any experiments into the composition of the dust in your mine?—No, I have not. I believe Professor Dixon, as well as Mr. Atkinson, took samples, but whether they carried out experiments or not I am unaware. I have examined the dust in connexion with these blown-out shots I have referred to.

6081. Will you please describe the cases of blown-out shots which have come under your own observation?—The first occurred at the middle pit, one of the two pits which have been deepened to the under series. This is a plan showing the two seams we work at this particular pit. The principal workings here are on the No. 6 or bottom seam, but the explosion occurred at Middle pit in the No. 5 seam, at a point marked A in the plan. This seam was won by a stone drift leading from the shaft to where it cut the seam, and the workings are show in green on this plan. The men were engaged in forming a road and putting in an unusually heavy shot in the bottom. It was extremely hard. They put in 15 cartridges of two ounces each, making 30 ounces. I think that was the exact amount of the powder.

6082. (*Sir William Lewis.*) Was it compressed powder?—Compressed powder. The result was that the shot did not do its work. It heaved up the floors a little, a small rent being formed under the adjoining walls; but it blew out absolutely nothing except the ramming. It caused a very great concussion.

6083. (*Chairman.*) You think that the explosion was wholly due to the powder?—Wholly due to the powder. The seam at the point in question was not dry or dusty. It had a top which gave off an amount of water, and kept the place generally damp. There was no dry coal dust. On the contrary it was rather wet.

6084. How far were the effects of this explosion or blown-out shot visible?—In this particular part of the pit the effects were felt at a distance of 300 yards away in *this* part *here*; but the effect was to blow out the lights generally throughout that part of the pit, and to open doors, and even to reverse the ventilation for a period of a few minutes. The effect, however, was not confined to that particular part of the pit, but took effect at a point 154 fathoms higher up in the upper group of seams—the Radstock group, where the concussion was distinctly felt, and even some doors were partially opened.

6085. And that was not in the direct line of the explosion?—Not at all. The air from the blown-out shot must have passed along this level stone drift—along the level of the road, and must have ascended the shaft perpendicularly 154 fathoms, and then taken effect.

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6086. (*Sir William Lewis.*) Was that against the current?—I believe it was. We were working with a brattice in the pit, with the 20 men limit, and the ventilation was not great.

6087. (*Chairman.*) How far along the levels did the force of the explosion extend after it had gone up the shaft for 154 fathoms?—I am not able to answer that question. The thing was not brought to my notice sufficiently at the time.

6088. But I understand you to say it did open doors along the level?—It did partially open them. I imagine at no considerable distance.

6089. But do you consider that it would be possible for 28 or 30 ounces of gunpowder to produce an effect at right angles to the direction of the shot and 900 feet above the place of the explosion?—It would appear so. I simply give you the facts as the result of my investigation. The question was put to the officials and the men who fired the shot. It was a very unusual shot applied in a most unskilful way, and there does not appear to have been any chance of the shot having any useful effect.

6090. Does not the extraordinary extent of the effects of the explosion suggest to your mind that some other cause must have contributed?—No, it does not.

6091. You think that the gunpowder alone would be sufficient to produce that result?—Yes.

6092. (*Professor Dixon.*) You regard it as an air wave running along the shaft?—Yes.

6093. (*Chairman.*) What impresses me is not only that it went straight up the shaft, but that it went a distance of 900 feet?—The distance makes little difference in a smooth shaft.

6094. On the level on which the explosion took place it went 300 yards.

6095. (*Mr. Fenwick.*) Was it an up-cast or a down-cast?—It was a down-cast.

6096. (*Chairman.*) The 28 ounces of powder carried the forces of explosion 300 yards on the level on which the explosion took place, 900 feet up a perpendicular shaft, and then for some unknown distance along the level on the top of that shaft?—You must bear in mind that it did not ascend the shaft at the end of the 300 yards. The distance between the shot and the shaft was not great—not more than 50 or 60 yards; so that the effect was not felt much further off going up the shaft than it was on the level.

6097. What strikes me is (and I put it to you for any observation you may wish to make) that if this shot had been fired at the bottom of the shaft and had then blown out, it would not have been at all surprising that it should have gone up the 900 feet or even more; but that, as a portion of the force of the explosion was expended in carrying the effects of the explosion for 300 yards on the level, it is a remarkable thing that what remained was still sufficient to go 900 feet up the shaft, and then again at right angles along the upper level?—It may seem extraordinary, but the fact is that the two things were simultaneous. The current or blast from the blown-out shot came in one body to this point where it must have been divided—one portion went up the shaft and expended itself in the shaft, which was, I suppose, the line of least resistance, and another portion turned in the opposite direction.

6098. (*Sir William Lewis.*) That portion going with the current?—Yes.

6099. (*Professor Dixon.*) How far was the effect of the flame visible?—I cannot give any evidence on that point, because my attention was not called to it at the time. I have the impression that the place was so damp that probably no effects of flame would have been shown. There was scarcely any timber to show it, the top being unusually strong and requiring no timber.

6100. (*Chairman.*) This was an extraordinary charge?—Yes.

6101. What would be an ordinary strong charge?—A pound, I should say, would be a fairly strong charge. Half-a-pound is a very common charge.

6102. Therefore this might be said to be nearly double a strong charge?—Yes; at all events it is double what we use in an ordinary way.

6103. I think we have had evidence that an ordinary blown-out shot does not go more than a few feet?—The flame, I should think, would not exceed perhaps 12 feet; but the concussion would extend much further.

6104. What was the condition of the dust in this pit at the time of the blown-out shot?—At the point where the shot itself was fired, as I have already said, it was not dry or dusty. In the adjoining No. 6, or bottom seam, it was as dry and dusty as the one which Mr. W. N. Atkinson visited and described.

6105. Then, I think, there was another explosion which also came within your experience?—There was at the Ludlow Pit, the second shaft that we have to the same seam, and there are plans showing its position (*producing plans*).

6106. I think this explosion, that we are now going to deal with, took place in the seam which Mr. Atkinson had previously described as being dusty, and as one in which he thought a coal-dust explosion was possible?—That is so. Its general position is shown here at point A. on plan No. 1. *This* is a plan of No. 6 or bottom seam, and the long wall face begins *here* and extends by a solid line, without any break, all the way round to the place at which the explosion took place. A slight break then took place, caused by a fault. Then there is a continuous coal face again from that point to another fault, where it ends; and the explosion took place at that point A. *Here* is an enlarged plan of that particular spot, plan No. 2 (*producing plan*). The shot in question is marked *there*. The workings had just passed through a down-throw fault of 3 feet, and that particular part of the long wall face being opened out inside the fault is represented by the curved line shown on the plan.

6107. Now what were the circumstances of that explosion; what was the loading of the shot?—There were four cartridges of two ounces each, making up eight ounces.

6108. Then perhaps you will describe the circumstances under which the explosion took place?—The men were opening out the coal in the way I have described, and they put a shot in at the point where the shot is marked. They put it in in a very unskilful way. They neither holed it under the seam nor over the seam, nor was it nicked at either end. So that it was quite a fast shot, and, although the charge was a very fair one, it practically blew out nothing. The shot was pointed in a sloping direction, as shown in the section. *This* wants to be turned about in the direction of the shot. The hole began in some inferior coal forming the middle part of the seam. It sloped slightly in the manner shown into the better part of the seam, and a little bit of the lip of the under part of the hole was blown out. But the remainder of the coal remained entirely firm and solid, and it was practically a fast shot.

6109. And where were the men when the shot was fired?—After lighting their shot they retired *here*, and were standing *here* at the time it occurred.

6110. How far was that off?—20 yards. I will mark that place E.

6111. The men stood at the point marked E?—Yes. There were two men, named Reed, passed through the door, which they closed behind them, and were at the point E when the shot went off.

6112. (*Professor Dixon.*) Which way does that door open?—It opens inwards.

6113. (*Chairman.*) Did the shot have any effect upon the door?—They heard it slam; but, seeing they had closed it behind them, it was not the slam of the closing of the door. It must have been merely that the concussion blew it up a little tighter against the frame, making a slight slam in so doing. But the door had been closed before. The door itself showed no sign whatever of fire, nor of any unusual force having been used. Over the door was a piece of brattice cloth stuffed in to fill the space over the door frame, and that was not blown out, although a very slight amount of force would have done that, nor was it singed, nor did it in any way show a trace of fire.

6114. What was the condition of the props after the explosion?—Some of the props showed marked evidence of fire. Those which are coloured dark red on this plan showed distinct traces of fire, and those that are coloured yellow showed none. The props that showed the most traces of fire were the two immediately adjoining the shot, and the effect became less and less as far as the red props are shown, until, at this point, it had almost disappeared. At *this* point, on the side towards the shot, there was a discolouration on the side of the prop towards the shot, and you could notice the sawn fibres charred a little at the end.

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6115. (*Sir William Lewis.*) That is in the direction of the current?—Yes, in the direction of the current.

6116. (*Chairman.*) How far did the effect of the explosion extend as shown by the charring of the props?—Eight yards from the shot.

6117. And that was the only direction in which the force of the explosion was felt?—That was so. I examined the workings in the opposite direction, and I could find no trace whatever of fire.

6118. Which way was the current?—The current was as shown by arrows on the plan passing up the head in a southerly direction.

6119. In the direction in which the effects of the explosion seem to have been felt?—That is so.

6120. And were there any men in the same direction?—There were three men not far distant. One man named Shearn was at the face of the adjoining road, and he was the only man who felt the effects of the fire. He was slightly burnt on the neck and ear.

6121. And what did the men who were there feel?—They felt a blast of hot air, accompanied with a good deal of dust.

6122. Was there any force?—There was force sufficient in the case of two men higher up the head, named Seymour and Whittock, to roll them over. They were in a stooping position at the time. But it must have been a very slight force indeed.

6123. Were the doors in the direction of the explosion affected?—They were opened at various places.

6124. And what was the condition of the mine as regards dust at the time?—It was dry, and as dusty as that seam usually is. The men are paid a special price for leaving the small coal under ground, so that the entire coal face is dusty from end to end. A large part of the small coal of the seam is left down, and of course there is necessarily a good deal of fine dust mixed with it.

6125. And that dust extends along the whole face of the coal?—It extends along the whole face of the coal shown on this other plan. It was not confined to the mere point where the explosion occurred but extended under precisely the same conditions right to the further end.

6126. Then do I understand that you think that if coal dust had contributed to the explosion it might have been continued along the whole face of the coal?—I do.

6127. (*Sir William Lewis.*) You did not tell us the length of this face?—374 yards on the south-east side of the blown-out shot and 110 yards on the opposite side—the north-west side.

6128. (*Chairman.*) Now do you think that in these explosions the coal dust that was present had any effect at all?—I believe it had the effect of extending the flame. There is no doubt as to that.

6129. But only for a few yards?—Only for a limited distance. I can give you the exact distance that the different effects were felt if you like to have them on your notes. The distance from where the shot was fired to where the man Shearn was slightly burnt was 80 feet. The distance from Shearn to Seymour, the next man, who felt the blast and dust, but sustained no injury, was 32 feet; and the further distance from Seymour to Whittock, the next man up the head, was 12 feet, making a total distance of 124 feet from the blown-out shot to the furthest man who took any special notice of the occurrence.

6130. Now do you suppose that the force exerted by this explosion might be wholly accounted for by the explosion of the powder, or do you consider that the coal dust had anything to do with it?—I think the coal dust contributed to it. It both lengthened the flame and I have no doubt contributed to the force.

6131. To that extent then the presence of coal dust in your opinion would add to the danger?—It would. But that danger I should consider a very slight one, because, you see, the traces of fire die out, as far as props are concerned, at a distance of 8 yards, and the risk of burning from the lengthened flame only extended to 80 feet, because the men immediately beyond sustained no injury.

6132. May I summarize, then, your evidence with regard to these two blown-out shots, and also your experience in connexion with the working of these seams in this way—that, in your opinion, coal dust alone will not produce an explosion, and that, although it may increase the effects of an explosion, it will not do so to any dangerous extent?—That is so.

6133. Do you think, then, under those circumstances that any additional precautions are necessary in such mines as those you have been describing?—No, I do not. The present Mines Act provides sufficiently for that if precautions are needed. As a matter of fact, I, as the manager of the mine, and the Government Inspector as the officer in charge, have neither of us ever considered it necessary to put in force the coal dust provisions of the present Act.

6134. I understand that your evidence applies exclusively to the mines which you have described and over which you have had control and to similar mines?—Yes.

6135. Are you acquainted with the experiments which have been made in connexion with coal dust?—I am, not with very great minuteness, but I have made myself conversant in a general way with those experiments.

6136. You are aware that on several occasions an explosion has been produced apparently by coal dust alone in the course of those experiments?—I understood there was only one that could be traceable to coal dust alone. One of the German experiments with a peculiar kind of coal dust from a seam called the Pluto seam. I believe that was the only one in the whole course of the German experiments from which they obtained an explosion from coal dust alone.

6137. Did not Mr. Hall obtain an explosion from coal dust alone?—He did in his shafts; but I do not consider Mr. Hall's experiments—valuable as they were in many ways—a fair example at all of the conditions which prevail in a coal mine.

6138. Does the same criticism apply to the German experiments?—The German experiments were applied to an artificial horizontal colliery, and, therefore, the same objection would not apply as in the case of Mr. Hall's. His experiments were carried out by riddling a considerable amount of fine coal dust down a perpendicular shaft with the mouth of a cannon pointed into it; and that represents a state of things that never does obtain in an ordinary coal mine. There was one solitary experiment that Mr. Hall tried, I am told, in a short horizontal colliery; but I am not aware of the circumstances of that experiment. The German experiments I understand were in an artificial gallery of considerable length, and, in so far as they were horizontal they more nearly approach the conditions of a coal mine; but still I should not consider that to have pure coal dust scattered about continuously and artificially in the way these experiments were conducted would quite approximate to the conditions in an actual coal mine, with all kinds of debris about in the roads and in the headings—coal dust and other substances alternating so, that I should hardly think the artificial conditions would approximate sufficiently nearly to the actual conditions to be good criteria to go by.

6139. Have you considered whether it would be possible to make any experiments which would in your opinion sufficiently approximate to the actual conditions to be conclusive?—I have. But there can be no better test than to find some disused coal mine, or district of a coal mine, in which you would have the actual conditions themselves. If you could find such a district, and possibly there might be such, you would then have something that you might safely go by.

6140. It would be necessary, would it not, to choose a mine where there was absolutely no gas?—That is so.

6141. And in that case even it would be extremely difficult, would it not, to watch the conditions of the experiments?—You could not watch the conditions of the experiments at the moment. But, by firing some shots so constructed as to blow out, or by firing a cannon, which was the substitute usually adopted, and doing so by electricity, you could see the effects afterwards.

6142. But how could you obtain any results from such an experiment more conclusive than the results which you have already obtained in actual working?—I do not know that you could, and, speaking from these experiments, I say that, as far as these blown-out shots that we have had to do with are concerned, they point conclusively to the fact that no dangerous explosion would be developed in the conditions I have pointed out.

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6143. What I would put to you is this. You told us that in the last 30 years you have fired 600,000 shots with, I suppose, the usual proportion of blown-out shots in your mine?—That is so.

6144. And that you have had no explosions?—That is so.

6145. Now if we were to experiment in that mine: if you were to hand it over to us for experiments, and we were to produce an explosion by a blown-out shot, would you be satisfied that the conditions were the same as those of the ordinary working?—Oh, yes. If it was carried out in the actual mine I could not dispute the conditions then.

6146. But we might have to fire 600,000 shots and get no result?—It is possible: it is probable. The first point on my evidence is, it conclusively proves that the ordinary shot-firing at all events will not either cause a lengthened flame or an explosion in a coal mine.

6147. (*Professor Dixon.*) In any coal mine do you mean, or only in your own?—In a non-fiery mine.

6148. If I understood you aright you said your experience goes to prove that any amount of shot firing will not produce an explosion in a dusty mine; now is that to be understood with regard to mines which have come within your own experience, or with regard to all coal mines?—I speak more particularly with regard to my own experience and the class of dust in the mine that we have to deal with.

6149. And are you prepared to generalise from that to other mines? For instance, you said that the dust in the Rhondda Valley was much greater and more inflammable than at Radstock?—I should judge so from the acquaintance I had, but it is not sufficiently extensive perhaps to justify me in generalising very much from it.

6150. You would not be prepared then to say there was no danger from such dust as that?—I would rather not express an opinion upon that.

6151. Then with regard to this shot in No. 6 seam—Ludlow's pit, you have given us the distance of 80 feet between this blown-out shot and the man, Shearn, who was burnt?—Yes.

6152. That is from the mouth of the hole to the man?—That is so.

6153. That probably was not the path by which the flame travelled?—No.

6154. The flame would probably have travelled a longer distance than that?—Yes, slightly longer. It could not have gone a very great distance; I should think not exceeding 30 yards.

6155. Would you call that long wall face in the No. 6 seam that we are speaking of "dry and dusty" within the meaning of the Act?—I think not; because I have not put in force the Mines Act regulation that would apply to a dry and dusty mine. But it is as dry and dusty as you usually find them in that part.

6156. You are, I presume, familiar with several of the Lancashire pits?—Yes, I have been down several of them.

6157. Would you call it as dusty as the average Lancashire pit?—I do not think I would.

6158. Do you know the Malago pit?—I do not know it personally.

6159. (*Sir William Lewis.*) What indications of force were there immediately opposite where the shot blew out?—I should say none whatever.

6160. No props knocked out?—Not a single prop.

6161. So that so far as you could see afterwards it was an indication of flame and hot air, and not an indication of force?—That is so. The only evidence we appear to have of force was the fact that the two men further on than the man who was burnt were rolled over from the stooping position in which they were engaged in their work, and a very small amount of force would have done that.

6162. Did the men at E feel any draught inwards to the face in consequence of the concussion of the blown-out shot?—No; they reported none.

6163. The door that is marked D in Reed's road would, by the concussion, have been opened inwards towards the face, and not blown towards the men at E?—The direct force I should have expected would have come on the back of that door, and blown it towards where the Reeds were, causing that slamming which they speak of. But I should have expected that there would have been a return current which followed it, but there was none reported.

6164. They did not feel any return current?—They did not report any.

6165. What was the quantity of air passing along this face at this particular time as far as you can ascertain?—It was a place of small area—the seam being thin, and the quantity was about 3,000 feet per minute.

6166. And the place a very confined one?—Yes. The air was travelling at the rate of 200 feet per minute.

6167. Was there any indication along this face opposite, where the shot blew out, of the small coal having been fired and deposited on the face?—I could detect none. There were on one or two of the posts tiny globules of coke as some thought, but they were not very decided; they were not very distinct. Mr. Martin, the Government Inspector of Mines, examined the place with me, and he has had an extensive experience in examining similar conditions after explosions, and he thought he detected these minute globules of coke and dust, but was by no means decided on the point.

6168. Is it possible that the explosion, to the extent that it was, was brought about by the existence of gas there?—Well, in the first place, I take exception to the word "explosion." I think it did not amount to an explosion at all. I cannot consider it anything beyond a lengthened flame. And in reply to the other part of your question, it is not possible that there was gas there, in my opinion. Because we have worked those seams for six years under all kinds of conditions, in the first instance, leaving the shaft bottom, with only piped air; in the second instance, with very moderate ventilation from brattice, and if there had been the slightest amount of gas produced at any part of this seam we must have detected it in the course of the six years working. The only kind of gas that we have found coming from the strata has been the carbonic acid gas, which in one instance came out of the rock in considerable quantities.

6169. Then, you have never heard any report of gas from the examinations of any of your firemen, nor have any of your colliers ever seen gas in the whole of your operations, some of them being in advance of the air, during the last six years?—None whatever, nor, as regards the other series within the whole 30 years.

6170. Has there been gas seen at other collieries working this second series?—I believe not. I have no personal knowledge of any.

6171. So that you would describe this as an inflammation?—An inflammation. The distinction between a lengthened flame and an explosion is, perhaps, difficult to define. But to amount to an explosion I should expect to find a much greater display of force than there was in this instance.

6172. Have the men described it as a great noise like an explosion?—No; if you were to go to the pit and ask where "the explosion" occurred they would wonder to what you were referring. They were quite unconscious of anything in the nature of an explosion having taken place. The most they said with regard to it was that the noise was the noise of an ordinary shot, only a little louder—a little more shake to it, and a little more noise, but nothing beyond.

6173. What was the tamping?—Clay.

6174. And do you take any particular precautions with respect to tamping where you have shots fired in the neighbourhood of dry and dusty places?—We do not; but, as a matter of fact, either common clay brought from the surface, or soft shale which may be found in the locality, is commonly used. I should say the result of some of these German experiments rather point to the fact that there ought to be prohibition of the use of coal dust of any kind for tamping.

6175. Then, as regards the number of shots that you have fired in coal and stone during the last six years, could you give me any idea of the proportion you have fired in coal?—No, I could not; but it would be a very small proportion.

6176. It would be principally in stone?—Principally in stone. Shooting in coal is practically confined to fast ends and places like these inside faults. The coal works fairly easily in the ordinary long wall face, and the powder is neither needed nor permitted.

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6177. So, if I understand you aright, what you suggest is, that the flame produced by the shot in blowing out came in contact with dust, and that was carried along by the air along the face?—That is so. The fact that the flame was in quite an opposite direction from the shot itself would point to the fact that the fire from the blown out shot, catching the fine and impalpable dust in the air, carried it off in the direction of the current. My view of the subject is very much what Mr. William Morgans stated in his previous evidence, that where the flame from a blown out shot is in immediate contact with the dust, it will no doubt cause combustion, and that may extend to other coal dust, and so it may be extended along the face. But the effect, judging from this particular example, rapidly decreases, and, at the end of 30 yards, practically it dies out altogether.

6178. Then I take it this was a most unexpected occurrence under the circumstances existing in this face at that time?—Entirely.

6179. But, that having taken place, do you think it is now necessary that any special precautions should be taken in firing shots in a dry and dusty place?—I have not considered it necessary to take any unusual precautions since this happened, nor has the Government Inspector asked me to take any.

6180. Do you find it necessary at all, either in the first or second series, to water any portions of your workings?—No.

6181. Either by water trams or jets?—No, not for the purpose of safety. We occasionally water them for the benefit of horses.

6182. (*Mr. Fenwick.*) At the point where this blown out shot took place, can you state the distance from the fault where the shot was located?—Not more, I think, than 3 feet.

6183. Have you worked coal extensively through this fault?—We had not then. We have extended a considerable distance inside the fault since. That was the first opening beyond that fault.

6184. Would you consider that there was more or less danger of gas being given off at a fault than in the ordinary course of the seam in working the seam?—As an abstract question there would be greater danger of gas coming off at a fault than where the seam was unbroken by a fault; but, as a matter of fact, although we have had faults at various parts of this district, we have had no gas given off from them whatever, except in the instances I spoke of just now, where carbonic acid gas was given out in considerable quantities, in fact it amounted to a blower.

6185. Have you gone through a fault of similar dimensions in any part of the seam to this?—Some as large and some much larger.

6186. And still, though you have had this exceptional case, I understand that you do not consider it is even necessary yet to put in force the provisions of the Mines Act against it?—No.

6187. In the middle pit did the force of the disturbance or inflammation, or whatever it may be termed, cross the shaft?—No, it did not cross the shaft. It went up to the shaft. The shot was on the same side as the shaft; the back of the shaft was walled, so that the concussion passing from the point of the shot out to the shaft struck against, I suppose, the walling at the back of the shaft and ascended perpendicularly.

6188. And would you not consider that the force would be somewhat broken in that case by striking against the back of the shaft?—No doubt it would be so.

6189. And even under those circumstances, do you not think that it was somewhat exceptional that, having thus struck the back of the shaft and broken its force, it should have ascended for such a distance up the shaft, and its effects even should be felt in the roadway of the seam above?—Yes; it did seem extraordinary, but I cannot alter the facts as they are reported, nor can I account for them in any other way than I have explained.

6190. (*Sir William Lewis.*) What would be the average sectional area in the direction in which that travelled?—About 12 feet. I am alluding now not to the middle pit, but to the Ludlow Pit, the one in which the man was burnt.

The witness withdrew.

Mr. John James Thomas called and examined.

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6191. (*Chairman.*) You are the manager of the Standard Colliery in the Rhondda Valley, are you not?—Yes.

6192. And do you come here also as representing the Colliery Officials' Association of the Aberdare and Rhondda Valleys?—Yes.

6193. These valleys, I think, include the largest and driest mines in South Wales?—Yes.

6194. Are they fiery mines?—Yes.

6195. You have had large experience with them?—Yes, I have had 28 years.

6196. How long have you been manager?—Fourteen years.

6197. Are you acquainted with the collieries in the district besides the one that you manage?—Yes.

6198. Has your attention been specially called to the influence of coal dust in explosions?—Yes, specially.

6199. Do you consider, as the result of your experience, that the existence of coal dust is a danger in a mine?—Yes.

6200. In what way?—In carrying on explosions.

6201. In carrying on explosions initiated from some other cause?—Yes.

6202. And do you think it can carry on an explosion for considerable distances?—Yes.

6203. Does it, in your opinion, add to the force of an explosion?—It may—the coal dust under ordinary conditions that would be about the tips, on the roads underground, in the faces, and in confined places.

6204. What have you to say about coal dust about the tips?—I have seen clouds of coal dust about the tips thick enough for an explosion from a naked light, if it were possible to make an explosion of the coal dust alone, and I have never seen anything of the kind. I have seen clouds of coal dust so thick that we could not see ourselves, but no explosion from it, although fires and large comet-lamps were in the middle of the dust clouds.

6205. Your conclusion from that is that coal dust alone will not explode with a naked light?—Yes.

6206. Then, has your attention been called to an explosion which took place in a hopper under those conditions?—Yes. I say it was an explosion from gas.

6207. How could there be gas in a hopper?—I think I shall be able to explain it under another head.

6208. I think we will take it now?—Fresh dust in confined places will give off gas, which will explode from a naked light, but the coal dust proper will not. We have found that from experience. Even coal dust under water gives off a little gas.

6209. Therefore your belief is that in the case to which our attention has been called, the explosion took place from the presence of gas given off from the coal dust?—From the coal dust. A quantity of coal dust that would require six men to handle about would give sufficient gas in the upper part of the hopper to be explosive.

6210. Then, coming to your second head, have you anything to say about the dust in the workings of the mine?—Yes. In roads I have seen dust so thick that it was nearly suffocating. We could hardly breathe in it.

6211. Do you think in that condition it is dangerous?—No, not from a naked light, because we have had naked lights in those cases.

6212. And in the faces have you observed the same thing?—Yes. In the faces again, from falls of coal or roof, clouds will rise to the same extent as on the roads.

6213. Then what I understand you to say is, that in what you call ordinary conditions, coal-dust will not explode?—Will not explode from a naked light.

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6214. That is what you call an ordinary condition?—Yes.

6215. What do you say, where coal dust exists in the quantities which you have described, as to the effect of a blown-out shot upon the coal dust?—The effect would be, provided that the flame be of a long duration, and the heat sufficient, that it would ignite the dust first, and the heat from that ignition would exude gas out of the dust, and then there might be a combination of inflammation and explosion.

6216. Therefore, dust which would not be dangerous with an ordinary naked light might be very dangerous in the presence of a blown-out shot?—Of a blown-out shot from gunpowder or from a low explosive.

6217. And the same thing, I suppose, would apply to dust in the presence of an explosion from fire damp?—Yes.

6218. That is to say, if there were an explosion from fire-damp taking place where there was a considerable quantity of dust, the explosion might be continued, and extended, and increased?—Yes, increased in some cases.

6219. Then what have you to say as to the effect of falls of the roof?—That would be just the same as I have said—it would cause large clouds of dust to rise. Those clouds of dust would not ignite from a naked light.

6220. Unless there was an explosion at the same time from some other source?—Yes.

6221. Have you observed any special effects of coal dust in connexion with safety lamps?—Yes. I never saw coal dust exploding in a lamp; it burns and inflames, but does not explode. There is a distinct difference between fire damp and coal dust in a safety lamp. The one explodes, the other only flickers and sparkles. That is my observation with the lamp.

6222. And what do you conclude from that?—That coal dust will not explode. There is great heat inside the safety-lamp, but the dust will not explode inside the lamp.

6223. It confirms your other observations that it will not explode by itself or with a naked light?—Not with a naked light.

6224. If the coal dust is mixed with fire damp, what difference does that make?—It makes very little difference inside the lamp. I have seen it in air-currents, where there would be sufficient gas to lengthen the flame of the lamp; and yet when a cloud of dust was raised, there would not be any perceptible difference in the length of the flame, only that the dust would flicker and burn.

6225. Do you think that coal dust mixed with fire damp is more explosive than coal dust alone?—Yes; it is more explosive, because the fire damp present goes part of the way to meet the gas that is given off from the dust, and then there would be less fire damp required to be given off from the dust to make it explosive if there were a little there present.

6226. Have you made any experiments in igniting coal dust?—Yes.

6227. With other materials than a naked light?—Yes, I made them with explosives.

6228. What was the result of those experiments?—That gunpowder or low explosives will ignite the dust, that is by firing some of the explosives in a heap of dust.

6229. And would the inflammation of the coal dust set up in that way be likely to extend far?—Yes, in a confined place in a colliery.

6230. Have you tried any of the patented flameless explosives?—Yes, most of them.

6231. And what has been the result?—That they will not ignite dust—I mean dust pure and simple.

6232. Will they not ignite it in any case?—No, not in any case.

6233. Does that apply to all the explosives you have tried?—To most of the high explosives. Those that I had on a special trial were ammonite, bellite, and Ardeer powder.

6234. Did you find that all these failed to ignite?—They failed to ignite the dust, each of them giving a little flash, but some less than others.

6235. You think that the flash which is given off from these explosives is not continuous enough or strong enough to ignite the coal dust?—It is not of sufficient duration.

6236. Therefore the danger from blown-out shots in coal dust would be materially reduced by the use of these explosives?—Yes.

6237. I think you have told us then that your conclusion from your experience is that although coal dust cannot initiate an explosion, an explosion may be initiated by a blown-out shot or a fire-damp explosion?—Yes.

6238. And then may be carried on by the coal dust?—Yes.

6239. And you have told us that one precaution against this danger is the use of flameless explosives?—Yes.

6240. Do you consider it necessary to take any other precaution?—I would suggest that the tamping of the high explosives should be with a damp material, and not with anything but a non-combustible material.

6241. And besides that, are there any other precautions, such as watering for instance?—Yes, would water around, according to the provisions of the Act. I have made a short summary on that point. The dangers from the presence of coal dust are secondary dangers arising from, first, gas explosions; and, second, from shot explosions. As a protection against gas explosions, the provisions of the Mines Regulation Act General Rules 1, 7, 8, 9, 10, 11, and part of General Rule 12 are sufficient, and I do not think can be improved. As protection against shot explosions, inasmuch as the dangers of shot explosions arise, firstly, from the use of a certain class of explosives, the gunpowder class, and secondly, from a certain condition of the coal dust (dryness), these dangers can be removed by abolishing the use of the gunpowder class of explosives and modifying the condition of the dust by watering as required by General Rule 12.

6242. What precaution do you adopt in the mine of which you are manager?—I adopt that.

6243. Have you any particular system of watering?—Yes, we have the pipe system.

6244. The spray?—The spray.

6245. Do you use compressed air?—No.

6246. Merely the pressure on the water?—Yes.

6247. And you get a sufficient spray in that way?—Yes, under sufficient pressure, which we can easily get at the deep collieries.

6248. Do you get in that way perfect saturation of the air?—Yes.

6249. You have taken hygrometric observations?—Yes, which correspond exactly with what Mr. Hood put in his evidence. I looked over his plan and evidence, and did not think it necessary to repeat it.

6250. Yours is practically the same system as his, except that you do not find it necessary to use compressed air?—Yes, that is my system.

6251. Since you have used this system have you had any explosions?—No.

6252. Is there anything else you wish particularly to call the attention of the Commission to?—I should like to mention one thing which corroborates what Professor Abel brought before the Commission, although I did it before I saw the notes of the first edition. Additional protection from the dangers of coal dust can be secured by the use of high explosives, but it is difficult at present to say which of the high explosives is the best. From personal experience I have found Ardeer powder to give the least flash—corroborating Professor Abel's evidence, 2474, in which he refers to explosives consisting very largely of sulphate of magnesia. Now the composition of Ardeer powder is 50 per cent. sulphate of magnesia and 50 per cent. No. 2 dynamite. So that corroborates what Mr. Abel says in answer to the question 2474.

6253. (*Mr. Fenwick.*) I think you are of opinion that there must have been gas present in the hopper or the explosion would not have taken place simply from the dust alone?—That is my opinion.

6254. Are you aware that the windows and the roof on the top of the hopper were not sufficiently tightened down to prevent any escape of gas that may have been

present in the hopper?—They may not be close enough to let off the little gas that would be given off from the coal dust when it was undisturbed. But with six men handling coal dust as they would do, it would give off a considerable amount of gas, which would, in coming in contact with the naked lights, start the explosion. That is my opinion.

6255. Then from your experience with regard to the clouds of coal dust that are present on the pit bank about the tips, where you have big fires and torches burning, that no explosion has occurred, that confirms your opinion that coal dust alone will not create an explosion?—Yes.

6256. But would not the conditions around the tips be totally different from the conditions that obtained in the galleries of a mine?—Yes, but I have made the same observations there, and with the same result.

6257. Have you tried to set up an explosion of dust in a mine?—I have not tried to set up an explosion, but I have been under such conditions when I could not help it—with naked lights.

6258. And with a large cloud of coal dust?—Yes, too thick to see. You could hardly see the flame. It was so thick that the flame would be a dim red light.

6259. Was it pure coal dust or mixed with stone of the roadways?—In most cases it would be pure, especially in the face.

6260. It was in the face?—It was in the face in some cases.

6261. And you had a naked light?—Yes.

6262. An open candle, or a torch-light?—An open candle.

6263. Not with a torch-light?—Not with a torch-light in the face. But I have seen torch-lights under similar conditions at the pit bottom—in the roadways.

6264. And did the dust sparkle on the candle?—A little around the flame. It did burn—but only what came into the flame did.

6265. But with a larger light—such as that of a torch-light which was used in the hopper?—It would not ignite unless there was gas present.

6266. You still think it would not explode?—Yes, I am quite clear on that point.

6267. (*Sir William Lewis.*) I understand that you come here representing the Colliery Officials Association; can you tell me what output you represent?—Eight million tons annually.

6268. You do not know the number of collieries?—Forty-five collieries.

6269. Are we to regard the views you have expressed as being the views of the whole of your colleagues or simply your own?—Partly my own and partly theirs. Most of them do not believe that it is possible to fire coal-dust pure and simple.

6270. But some of them do?—I do not know.

6271. Is there anyone who would say that dust alone would explode?—I do not think so. If you put it in that way, if you asked them if it was possible for dust alone to ignite I do not think any of them would say that it would from an open light or even a torch; but from the explosion of an explosive it may.

6272. A blown-out shot?—Yes.

6273. You are all in accord that a blown-out shot could initiate an explosion?—Yes, under certain conditions.

6274. Through dust in the immediate neighbourhood of the blown-out shot?—Yes.

6275. And without any gas?—Without any gas to commence.

6276. Did I understand you aright that you believe that dust is always giving off gas, or is it simply from dust arising from fresh wrought coal?—I think that dust always gives off a little gas; but it gives off more when it is fresh.

6277. You spoke of flameless explosives?—Yes.

6278. From your experience, are you able to mention a single explosive that you have used that has never produced a flame in any of your shots?—I have not known them without any flame; but I have known them without a perceptible flash even in the darkness of the mine.

6279. Have you had a blown-out shot with any of these flameless explosives?—I cannot say that we have.

6280. So that really you have not tested them under the same conditions as a blown-out shot with gun powder?—Not exactly.

6281. Is the comparison, therefore, conclusive in the way you put it, unless you have had a blown-out shot with one or more of these so-called flameless explosives. Surely you could hardly compare what the conditions would be as against gunpowder?—I see what you mean. I think I must correct myself. We have seen some of the high explosives exploding in a manner that would be equal to a blown-out shot—that is exploding part of the charge—then it would blow out.

6282. Then would you consider it safe to use even what you describe as flameless explosives in the midst of dust in our steam coal measures, without taking the precautions provided for in the Act of Parliament for watering?—No, I would not do that, although I do not think that these high explosives would fire the dust. But still I would not do it without watering.

6283. You have said that you do not believe that there is an entire absence of flame?—Yes.

6284. But it is, you say, scarcely perceptible; therefore it follows that they would not be quite so dangerous, in your opinion, as a blown-out shot from powder?—Yes.

6285. Still, from your experience of watering arrangements and the precautions that you adopt in compliance with the Act of Parliament, you do not tell the Commission that any further precautions are necessary in the working of the collieries in the Aberdare and Rhondda Valley as regards dust?—Yes, that is what I say.

6286. You speak not only as a manager, but also as having been a collier yourself for years?—Yes.

6287. What would you regard as sufficient to convince you as to the possibility of dust itself initiating an explosion?—It would be to try the hopper under the same conditions with a safety-lamp instead of a torch. I think there would be gas found at the top.

6288. Would that convince you?—Yes.

6289. You would not require experiments to be carried out in, say, a gallery formed on the surface with pretty nearly the whole of the conditions that exist in a mine?—I am quite satisfied myself with what I have seen.

6290. You say that powder may initiate an explosion with a blown-out shot in the midst of dust?—Yes.

6291. But an ordinary flame could not possibly in your opinion initiate an explosion?—Not from dust alone.

6292. (*Lord Rayleigh.*) Do you think further experiments are desirable in the comparison of different explosives with one another?—Yes; I think that would give us more satisfaction generally on that point.

6293. Your own opinion is in favour of the claims put forward on behalf of the high explosives as being less dangerous?—Yes.

6294. But are mining authorities generally in agreement with you on that point?—I think most of us in South Wales are agreed on that point.

6295. But you think it might be well to arrive at greater certainty by special experiments conducted by competent authority?—Yes.

At 23, Great George Street, Westminster, S.W.

SEVENTEENTH DAY.

Friday, 16th March 1894.

PRESENT:

THE RIGHT HON. JOSEPH CHAMBERLAIN, M.P., CHAIRMAN.

LORD RAYLEIGH.
Sir WILLIAM LEWIS.
Mr. CHARLES FENWICK, M.P.
Professor HAROLD DIXON.

Mr. J. WILSON, *Secretary.*

Mr. T. Y. Garthwaite.

16 Mar. 1894.

Mr. THOMAS YOUNG GARTHWAITE called and examined.

6296. (*Chairman.*) I think you are general manager of the Camerton Colliery, and that you hold a First Class certificate?—Yes.

6297. Have you had experience elsewhere?—Yes; I have had experience in Durham and Northumberland as pupil to a mining engineer, and some little experience in Yorkshire, and also in Gloucestershire and Somerset, as a manager, and advising in the management of collieries.

6298. Can you give us some information as to the particular colliery with which we are going to deal to-day, namely, the Camerton Colliery?—Yes. The Camerton Colliery is situated about three miles from Radstock, and about seven miles from Bath.

6299. What are the seams worked?—The seams worked are the upper series of the upper division of the Somersetshire coalfield.

6300. (*Sir William Lewis.*) Do you happen to have a vertical section of the pit, so that the Chairman might see it?—I have not a vertical section of the pit with me.

6301. (*Chairman.*) At what depth is the seam worked?—The pit is 314 yards deep, and in that pit five workable seams are proved: the great vein, the top little vein, the middle vein, the sliving vein, and the under little vein. I have taken them in descending order, the great vein being the upper vein.

6302. In which seam did the explosion about which you are going to give evidence take place?—In the great vein at the new pit of the Camerton Colliery.

6303. For how long has this pit been worked?—The pits have been at work for upwards of 100 years.

6304. How long has this particular seam been worked?—The whole of the time—the greater part of the working would be in this particular seam; the largest quantity of this seam would be worked.

6305. Have there been any explosions in the pit before?—No, there is no record of an explosion of any kind, or of the ignition of either dust or gas, that I have ever heard of.

6306. Has the presence of gas been manifest at any time?—No, it has never been reported or recorded.

6307. Did you use safety lamps in the pit?—No; I think it is probable that a safety lamp was never in the pit until after this explosion took place.

6308. You have never thought it necessary, nor has it been thought necessary to the best of your knowledge to use any precautions against gas in this pit?—That is so; no precautions have been taken.

6309. And you have been exempted, I think, from the clause of the general rule, which applies to gassy pits?—Yes, from so much of it as relates to the carrying of gunpowder into the mine in cartridges, that is Clause B. of General Rule 12. We are allowed to take loose powder into the mine. That exemption was granted, I think, on account of the safety of the pits, and their freedom from gas. At least, that was the ground on which we asked for it; but I could not say whether that was the ground on which it was granted.

6310. How do you carry out blasting in the pit?—It is carried out with loose powder. The men charge the hole in the ordinary way with loose powder, stem it, and fire it with a straw filled with powder, or sometimes with a squib, occasionally with a fuse.

6311. I suppose gunpowder has been used for a long period?—Gunpowder has been used ever since the pits have been worked.

6312. Is the powder used for the purpose of getting the coal?—Very rarely. It would be a very uncommon circumstance for a shot to be fired in the coal. Such may have been occasionally the case, but very seldom.

6313. It is used in the rock, is it?—It is used principally for making the roadways. The seams are very thin, and the top is blasted down to make a sufficient height for the trams to pass along to the face of the workings.

6314. Do you know at all how many shots you would fire in the pit in the course of a year?—On an average about 50 lbs. of powder is used per week, which would represent somewhere about 100 shots per week.

6315. Is there any change in the way in which the powder is now used as compared with the way in which it was used formerly?—Yes, there is a change in this way, that larger holes are bored now for the powder. Formerly they used a drill which bored about an inch hole; now the holes are about an inch and seven-eighths. Sometimes they use the smaller drills, but mostly the larger ones.

6316. And the object is to take a larger charge?—Yes, to do more work. The reason of it is that now they use machine drills, which they work with a ratchet brace, but formerly they used hand-drills. With the machine drill they get a larger hole.

6317. How long has the new practice prevailed?—It has gradually grown up within the last five years.

6318. Is the pit a dusty pit?—We do not consider it a dusty pit. Compared with pits that I have known in other districts, I should certainly say it was not a dusty pit. I have in my mind more particularly the Durham pits that I have seen. In those pits the trams and horses passing and the journeying of the coal raises a considerable dust along the roadways. In our pits we do not find the dust disturbed by the passage of the men or of the horses, or in the inclines by the passage of the coal along.

6319. Is the dust which is there pure coal dust or is it mixed with other material?—It is considerably mixed with shale, and that would be more so the nearer you get to the working faces; as you get further away from the working faces the coal dust would be purer.

6320. Now coming to the recent explosion, when did it take place?—About midnight on the 13th November 1893.

6321. Would you give the Commission the details of the explosion?—In the particular district where the explosion occurred there were only two persons at work, a man and a boy. They were sent there to rip down some of the roof of the incline. Owing to the upheaval of the floor the roadway had become small, in fact too small for the loaded trams to pass at that point. They were grinding against the top, and some

of the coal in that process of grinding was deposited as dust, which caused the road to be dusty at that point.

6322. At the time of the explosion then the district was in a dusty condition?—At that particular spot where they fired the shot the roadway was dusty.

6323. In the course of their work had they to fire shots?—That was their instructions, to fire in order to rip some of the top to make more height. They actually had fired one shot previous to the explosion—a shot where the hole was 21 inches long.

6324. Were those two persons killed by the explosion?—Yes. When we found them they were considerably burnt, and no doubt it was from the firing of the shot. There was evidence that they had fired a shot immediately before.

6325. What I want to know is were they killed on the spot, or were they able to give any evidence as to what took place?—They were dead when we found them.

6326. Nobody therefore is able to give evidence as to what actually took place?—No, there is no one who can do that.

6327. What do you consider took place?—Our reasons for thinking that they had fired a shot were that we found a prop immediately in front of this hole that they had bored, against which they had evidently rested the machine in boring; we found the boring tools placed in a refuge hole close by; we found a certain amount of débris blown down by the shot; and we found their candlesticks in a refuge hole where they had evidently been sitting out of the way while the shot went off.

6328. Are you referring now to the first shot?—I am referring to the fatal shot, if I may call it so, the shot that caused the accident.

6329. Do you know whether before the fatal shot any other shots were fired?—Yes, they did fire one.

6330. They did fire one before?—Yes.

6331. Have you any idea as to how long before?—They would get to their work about 9, and the shot which caused the explosion was fired about 12, so probably they fired the other about from one to two hours before that.

6332. They would not fire two shots one immediately after the other?—No, they did not do that, because they had cleared the rubbish away that they had got from the first shot, so that an interval must have taken place between the two sufficient to do that.

6333. Therefore the first shot could not have had any influence on the explosion?—No, the first shot had none whatever, further than that it may have disturbed the dust in the neighbourhood and made more dust in the air.

6334. Would that dust have remained in the air for two hours?—They had to remove the stuff some few yards down the incline and this they did in a "putt" as we call it locally—a sort of box or sledge; it would raise some dust in dragging this on the floor, and probably the second shot would follow close upon the completion of this work.

6335. Then coming to the second shot, did you find the trace of that?—We could see the mark in the roof where it had been fired, the length of the shot and so on. I have with me a plan and a section of that shot if you would like me to produce them.

6336. Yes, if you please?—I have also with me a plan of the workings. (*Producing plans and explaining them.*) The plans show where both shots were fired. *That* upright is the upright they had the machine placed against in boring. That upright was left standing after the shot.

6337. (*Lord Rayleigh.*) The purchase was against that upright?—Yes; the boring tools were found *here* in *this* manhole or refuge hole, and the candlesticks were found in *that* refuge hole.

6338. (*Chairman.*) Where were the bodies found?—The boring tools were found at 13 yards from the shot in the refuge hole, and the men's candlesticks were found at 35 yards from the shot in another refuge hole where the men had evidently been sitting at the time of the shot. They left their candlesticks there and tried to escape, and they were found at 54 yards from the shot or about 19 or 20 yards from the refuge in which they were sitting.

6339. The idea is, I presume, that when the explosion took place they immediately ran out?—And left their candlesticks.

6340. And tried to get into safety?—Yes, I have supposed that they saw some flame and fire by their leaving their candlesticks there, or else I think they would have made some attempt to take them. *This* plan is a general plan and *that* is a detailed plan of the shot. *That* is a plan of the direction of No. 2 shot. It struck the bottom of the incline at a bank of débris *here—this* is a bank of dust and débris—at a distance of 9 ft. 6 in. At that point the dust was coked, and the coked dust driven into the crevices of the rock *there*, and this prop and this piece of wood *here* were thickly coated with coked dust.

6341. Was it charred then?—The timber was not charred, it was rather that coked dust was deposited there.

6342. Was there any mark of charring anywhere in the workings?—There were some slight marks of charring and marks of coked dust on the timber. At this particular point where the shot struck, as I have already said, we found it, and going outwards, on the prop and chump of wood on the incline, on the corner of No. 2 refuge hole. *Here* is the prop and the chump of wood. At that point we found coked dust. A food bag that was hanging *here* was also charred; the bottom of the bag was so charred that the food dropped through on to the bottom and left the bag hanging there. A plate of iron was in this No. 2 refuge hole, and that also showed signs of coke charred dust being deposited upon it.

6343. How far did you find traces of the explosion?—The last fall of roof is 1,261 yards from the shot going outwards. *This* is a plan of the workings. The shot was fired *here* and the bodies were found *there*. *This* is the bottom of the incline, and *here* is the pump corner; *that* is Tom's road and *this* is the horse road. The green shows the road on the great vein and the red shows the furthest limit of the explosion.

6344. Would you just point out what was the course of the explosion in reaching this point?—Down the incline and along in the great vein road. This is a cross branch to that point. That was all against the current of air I may say; *that* was the intake air-way; the explosion was against the current of air and in *this* direction; it travelled into that second door. That was the furthest point that we could trace it.

6345. Were you able to discover where the explosion was strongest?—The force of the explosion was very little on both sides of the shot for some distance. The force seemed to become greater as it went further away from the shot. At *this* point, 1,180 yards from the shot outwards, the violence of the explosion was more noticeable than anywhere else. There are two doors shown on the plan at that point. These doors were blown into fragments, and the door posts and door framing were shattered as if a violent explosive had been fired right into them; in fact the iron framing of the door, $1\frac{3}{4}$ inches by half an inch, had been broken in two and bent and contorted very much.

6346. Have you formed any conclusion as to the reason why the explosion stopped where it did?—It seemed to be owing to the dampness of the road near this point. As soon as the road became less dry—damper and muddier—the explosion stopped apparently. In going inwards, in the same way, at the working faces there is more moisture, and a considerably larger proportion of shale mixed with the dust.

6347. Were there any other men in the course of the explosion?—No, there were not. There were men employed in the new branch shown on the plan, but that was a separate air current, and they did not feel the effects of the explosion in there. They felt some slight shock at the time it took place, but nothing noticeable.

6348. Have you arrived at any conclusion as to the cause of this explosion?—Yes, I have come to the conclusion that the explosion was initiated by the firing of the shot, which was overcharged, and that it was carried on by the agency of coal dust and without the presence of fire-damp or inflammable gas, beyond any that may have been evolved or distilled from the dust.

6349. You do not think there could have been any gas present from fissures or from the seam?—I see no chance of that. In the first place, for 100 years there is no record of the slightest symptoms of gas, and we

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had not cut any faults or anything in that neighbourhood that may have tended to cause a discharge of gas. In fact the workings were in their general normal condition, and there was no reason to suppose that any gas was coming off, nor have we found any since.

6350. Can you give me any reason why no explosion ever occurred before under similar circumstances?—I think the greater length of the roadways is one reason. The workings at that point are very much further from the pit than they have ever been before; consequently the coal had a greater distance to travel, and the waggons being open at the end causes a considerable leakage of dust. The waggons come down this incline at a great speed, which rather aggravates it; and then the grinding against the roof of the incline made more dust than would usually be deposited there.

6351. Has there been any change in the ventilation?—The ventilation has been increased of late years. It has been increased in the last 12 months. There would be considerably more ventilation going into that particular district and into the pit as a whole.

6352. Do you think that has had any effect?—Yes; certainly we have found the roadways very much drier since.

6353. Has this accident led you to make any change in the conduct of the workings?—Not in the working faces; we have made no change there, but we should take more precautions in firing any shots in the roadway again.

6354. What precautions would you take?—For one thing we should be particular to carry out all the provisions of the rule as to dry and dusty mines, that is, as to watering and the removing of the dust; then we should use one of the higher explosives instead of powder, and we should take care that men well known to be competent were appointed for any shot-firing of that kind.

6355. Do you propose to give up the use of powder altogether in the mine?—We have not proposed to do so in the working places.

6356. Why is that?—The working places are damp as a rule; and not only that, but there is a considerable quantity of shale mixed with any dust that may exist there. The seams are very thin, the thickest is 2 feet, and the thinnest about a foot, and there is a considerable quantity of shale got in making the height for the waggons to travel.

6357. What would be the objection to using high explosives in all cases?—The only objection that I can see is that each man in each working place makes his own roadway, and so it would be putting these high explosives into a great number of hands, some of whom perhaps might not be careful in using them, and there might be a danger in that way.

6358. Are they more dangerous to handle than gunpowder?—I suppose that some of them are not more dangerous to handle, once the men become accustomed to their use.

6359. Is there any other objection except the difficulty in handling them?—I suppose the question of cost would come in; but beyond that I do not know of any.

6360. What would be the difference of cost between a high explosive and a charge of powder such as you have been accustomed to use?—It would be somewhat higher—a high explosive would be more costly.

6361. But how much?—I suppose it would depend a great deal on what explosive you use, but I should think roughly about a third more in cost.

6362. What would be the value of that third in money; would it be a shilling for a single charge?—No, it would not amount to that.

6363. I want to know what would be the difference in cost, of a single charge, between gunpowder and an ordinary high explosive?—We must take some particular charge to get at that.

6364. Take such a charge as you have been speaking of—a hole of one and seven-eighths of an inch?—It would not be much on a particular shot, perhaps a few pence—two or three pence it may be—not more than that.

6365. In your mine there are 100 shots a week?—Yes, that would be somewhere about it.

6366. Therefore the extra cost of using the explosive would not be more than about 15*s*. a week?—That is so.

6367. Do you not think that it would be worth while to the owners of the mine to go to an extra expenditure of something like 40*l*. a year in order to get the greater security?—Certainly, if there is any danger in the working faces it would be necessary to do it.

6368. But this explosion shows that there may be danger, does it not?—I am hardly prepared to admit that in the working faces; it shows it in the roadways. The conditions are different. As soon as this explosion got anywhere near the working face it died away directly. That rather tends to show the safety there if anything.

6369. You attribute that to the fact that the working face is damp?—That the working face is damp as a rule, and that a large quantity of shale is mixed with any coal dust that may be there.

6370. Why are the working faces always damp?—We find a certain amount of moisture given off generally from the roof over the coal on the great vein, and on the other seams as well.

6371. Before this explosion were you an advocate of what is called the dust theory?—No, I was not. As far as I myself was concerned I should have allowed anyone to try any experiments in our pit. I was so confident that the dust would not explode.

6372. But you feel now, as I understand, that there is no other possible explanation of the present accident except that it was a dust explosion?—There is no question in my mind about it. I can see no chance of there being any other cause.

6373. (*Sir William Lewis.*) I see some faults marked upon your general plan?—Yes, that is so. I may say that we have a very large number of faults at the colliery; they are not shown on this plan because it does not show all the workings; it only shows that particular district.

6374. I was going to ask you if this shows the whole of your faults?—No; we have, as I have said, a very large number of faults, and they are of a considerable size.

6375. Can you point out to the Commission the nearest fault?—This (*pointing to the plan*) is the only fault that was near there.

6376. How far was that from where the shot was fired?—About 180 or 190 yards.

6377. Under 200 yards?—Yes.

6378. You have shown a fault here near this staple which is stopped there; does not that extend further?—No; that fault dies out.

6379. Where you have struck faults hitherto have you found gas or water or both?—We find a little water occasionally, but never gas. I have climed high up in the drivings that have been driven in a fault many times where, if there had been any gas present, I should certainly have found it.

6380. You have never seen any gas in striking any of these troubles?—No, never. In the history of the colliery there has never been known anything to fire.

6381. If this plan correctly shows it, this place was in the goaf, and there are old workings on both sides?—That is so; it is cut off in the coal on *this* side, and cut off by the fault on *that* side.

6382. What takes place after the coal has been exhausted; do you stow up the vacant place or is it left to fall?—There is no vacant place except in the roadways; the seams are so thin that not only do we fill all the vacant space but we send out one load of rubbish to every four of coal; we have to bring that to bank in addition to filling all the vacant space.

6383. You do stow up the place where the seam has been extracted?—Wherever the seam is worked it would be nearly close as a rule except that the roadways would be open unless they are filled—sometimes we fill them when we can get the chance to do so, that is we fill the roadways as well as the space between.

6384. There must be some vacant space. You could not stow that as compactly as it was when the seam was there; do you think it is possible that any gas may have accumulated over a long period in any of these places?—No, I should think it was quite impossible for the simple reason that not only I myself, but hundreds

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of men, going back a hundred years, have been travelling through these old places with a naked light, (with a candle), and in many instances I myself have been 100 yards or more in front of the air current—if any gas were there I should have expected to have seen it, or that some one else would have done so, at some time.

6385. Did you ever test for gas?—Not with a lamp

6386. Did you ever test with the flame of your candle?—No, I should never have thought of it in these pits; in fact so little did we think of gas that after this explosion occurred the men that were in this new branch never dreamt that it was an explosion, although they had to come out over the falls. The only reason they could assign to me for the state of affairs was that they thought it was an earthquake. That it was an explosion never entered into their minds. I think it was the same with everyone there. As to testing for gas we should never dream of it.

6387. What does your fireman do when he goes round in the morning before each shift?—He goes round with a candle, a naked light, and sounds the top of all the working-places to see that the roof is secure, and sees that the ventilation is all right, and any other source of danger he would report.

6388. But he never thinks of testing for gas?—No, nothing of that.

6389. Have you any record of the number of blown-out shots that you have had at the colliery over, say, the last few years?—No, we have had no record of them.

6390. Have you ever known a blown-out shot before?—Not of my own knowledge. I have not seen one. I daresay the examiner, who is here, would be able to tell you.

6391. I think you said this was a partly blown-out shot, but that it did some work?—It was a partly blown-out shot. In most cases with these machine holes you can see some piece of the stemming in the holes; but in this case there was nothing whatever; it was evident that a mass of flame had gone down into the dust, and the débris at the side, and the very little work that it did would lead one to think it was over-charged, as a man would not put a hole in of that kind to do so little work as it did.

6392. The shot had not done its work?—I should think about a hundred-weight of débris or stone was brought down by the shot.

6393. Have you seen shots placed under similar circumstances where there has been dust on either side before?—A number of shots have been fired in this same incline where it was dusty and nothing occurred.

6394. Equally dusty to what you assume it was at the time this shot was fired?—Yes, or nearly so. The examiner will be able to tell you more upon this point; but I think that most of them would be bored with a small drill and would not be likely to be over-charged. Of course it is very difficult to over-charge an inch hole with powder.

6395. Now take the shot that was fired, I think you said to the Chairman, a couple of hours previously?—Yes, or about that time.

6396. So far as you could judge that shot had done its work?—Yes, it did very good work.

6397. How do you account for that charge having gone off without any explosion when the dust was lying about in the same way, and this causing an explosion in two hours afterwards, the difference being such as you have indicated, that it did not do its work—unless there was something else than the dust in the immediate neighbourhood of the shot?—I would account for it in this way: In the case of the first shot the mere fact of its doing its work shows that there was very little flame coming out of the hole—in fact I could see that from the stemming which was left in the hole. I could trace the stemming left in there, showing that the stemming was not blown out.

6398. Are you speaking of the first shot now?—I am speaking of the first shot; you could see the marks of the stemming left in the hole. In the second instance, you could see no mark whatever of any stemming, it was all blown clean out. In addition to that the second shot was pointed more directly down into the dust; it struck the dust at 9 ft. 6 ins. from the hole, and the first shot would strike considerably further down the incline.

6399. Do you think that of itself would account for the difference in the effect of the two shots?—I think it would have a great deal to do with it, if, as I suppose, one was nearly a blown-out shot and the other was not. This No. 1 shot is pointing more *that* way; and not only that, but it blew a large piece of ground out. No. 2 shot only blew out this little piece *there*. You will see it on the section better. That is the end view looking up the incline across *here*. It blew out a very small piece of ground *there*.

6400. Did it occur to you that there was any great force when this shot blew out, having regard to the fact that none of these timbers were blown out?—There was very little force to be seen for a considerable distance each side of the explosion; there is very little sign of force for 128 yards outwards from the shot; then you come to the wheel on the incline; this wheel has shifted from its position; then you get a succession of large falls extending to the bottom of the incline, 311 yards from the shot—that incline is nearly one continuous fall with the exception of a few timbers left standing.

6401. All in the direction of the fresh air?—All against the fresh air.

6402. Were those portions from your previous knowledge of them more dusty or less dusty than where this shot was fired?—The point in the immediate neighbourhood of the shot would be more dusty, and the incline to the bottom would be more or less dusty. On the little vein from the bottom of the incline to the bottom of the dipple, it would not be so dusty; but with the exception of that the whole of the great vein road and the horse road would be dusty. When you come to the main branch, where the explosion ended, for a distance of 80 yards or so is more or less wet and muddy; there is moisture present both on the bottom and in the top.

6403. Were there any places along *here* that were wet and where the explosion continued, notwithstanding the wet places?—No; the great vein road from the dipple outwards to the pump corner would be dry throughout, and it would be more or less dusty.

6404. But not what you previously considered dry and dusty in the ordinary acceptance of the term?—I did not consider that our pits were dry and dusty in the ordinary acceptance of the term at all, as far as my experience of other pits compared with this goes it was not dry and dusty. The coal dust was not pure, it was mixed with shale and heavy, it would not float away with the air-current. On being disturbed it would not float away.

6405. What is the thickness of the strata between this seam and the next seam immediately below?—From 10 to 12 fathoms, that is from 20 to 24 yards.

6406. Do you ever have any upheaval at the bottom under this seam?—Yes, the bottom is a soft black shale, and it does heave, especially where there is any moisture in it.

6407. Are there any riders between that seam and this coal, or is it simply rock and shale?—In most instances it is simply rock and shale.

6408. Then what is the next seam above this?—This is the top seam.

6409. What is the nearest coal here. You have some thin riders, if I remember your section aright; there is a rider, I think, above this great vein, is there not?—Not anywhere near it.

6410. How near?—Not within 30 or 40 fathoms, I think, not at our pits—at some of the pits it is so.

6411. It is so at Radstock, I know?—Yes, it is so. There is a seam at Radstock, I think they call it the Witty Mills Seam, which does not exist at our pits; that is above the great vein.

6412. I did not know that your section was so different. When you have had falls of roof, have you ever observed any difference?—In what way?

6413. Have you never had any gas of any kind either from falls of roof or from the lifting of the bottom or out of the seam?—No. I have been on the top of falls of roof, and, as I have said, I have climbed up beside the face of faults; if there had been any gas there I would have been sure to have found it.

6414. And the only reason that I understand you can suggest for the difference which has led to this explosion was the size of the bore?—And the greater length of roadway and the open end trams.

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6415. And that it was practically a blown-out shot?—And that it was a blown-out shot. I may say that I am having our waggons made close in the end. I think the Chairman asked me what precautions should be taken. I forgot to mention that. A precaution which I should suggest and act upon is that the waggons should be made as close as possible to prevent leakage.

6416. That would be a precaution as regards quantity of dust only?—That is so, as to the quantity of dust in the roadways.

6417. Do you use much powder in the face, in the actual getting of the coal?—No, it is very rare that a shot is fired in the coal.

6418. And you would not think it necessary. I gathered from an answer you gave to the Chairman, that the same precaution should be taken in the face where the dust is mixed with shale, as you would in the roadways where it is fine dust?—No, I do not see that the same precautions are necessary there.

6419. In one of your answers you indicated that in your opinion this was due to want of experience on the part of the particular workmen—that the hole was badly put?—Yes, it was badly placed and over-charged. There was very little work that it could do; there was a joint at the back of the hole which prevented it from spreading further.

6420. Were they men who had had considerable experience in the mine, or were they working in coal without having had much experience in hard ground?—The man had had a certain amount of experience in hard ground, but perhaps not so much as some—he had worked in the pit from a boy, and had had general experience of all the work.

6421. (*Mr. Fenwick.*) What do you understand by a dry and dusty mine?—As far as I know there is not an absolute definition of a dry and dusty mine. When I speak of our mine as not being dry and dusty, I have other mines in my mind with which I compare it, more particularly the Durham ones.

6422. Then we may take it that you are speaking comparatively?—Comparatively.

6423. And that this mine was not so dry and dusty as other mines?—That is the case.

6424. But is it not the fact that you had to load up the dust each day from the incline?—No. I think that was not done each day, it was done from time to time. Certainly, as I have said I think, in my evidence, at the point of the explosion, it was considerably drier and dustier than at any other point.

6425. At any rate if not each day at short intervals you had to fill up this dust into the trams, and send it out of the pit?—Yes, but it would not be all coal dust—the bottom is very soft at that point, and is constantly heaving up; that and the grinding from the passing of the trains would produce a black shale dust mixed with the coal.

6426. Did you ever take any precaution to water the dust before firing the shots?—No, we have never done that. Our roadways are not dry and dusty as a rule. At this particular point, it was more like a dry and dusty roadway than at any other point in the pit.

6427. I think I understood you to say that your fireman examined the mine before the workmen went in with a naked light?—That is so.

6428. Do you think that that is a wise practice, or a safe practice I will put it?—Taking the pits on the upper series about Radstock, I suppose that there is hardly one of them that has at the present time a safety lamp in the pits, and some of them have been working considerably longer than we have—that is, over 100 years. There is no record of any gas having been seen or found.

6429. Do you think that the fact that there is no record of any gas having been found is a sufficient justification for examining the mine in the morning without taking the proper precaution of having a safety lamp?—Yes, that is how we look at it.

6430. Is it not possible that during the night a disturbance may have taken place which may have liberated fire-damp from the strata, of which you have not been aware?—It might be possible, but it seems very improbable, considering that, as I say, we have had a very large number of faults there. They have been cut many times during the last 100 years, and nothing of the kind has ever been found.

6431. What evidence have you that this was an over-charged shot?—It is perhaps a great deal assumption. We assume that the man would not put in a hole of that kind to blow down so little stuff as he did, and that he must have had an intention in his mind to do more work than the shot actually did. I have examined the hole very carefully, and as far as I can see from the blackening inside the hole, I think he had about $4\frac{1}{2}$ inches of powder in there. If he had that amount of powder certainly it would be an over-charged shot for the amount of work that it did.

6432. (*Sir W. Lewis.*) A $1\frac{1}{2}$-inch hole, did you say it was?—No, $1\frac{7}{8}$ of an inch.

6433. (*Chairman.*) What was the length of the hole?—It was 10 inches in length altogether.

6434. Therefore about half of it was filled with powder?—Yes, nearly half; that is as far as I could judge from the blackening within that part of the hole that was left.

6435. (*Mr. Fenwick.*) But is it not possible that when a shot has not done all that it was intended to do, the fact that it has not done that may be due to an under-charge as much as to an over-charge?—Yes, it might be so, but then anyone going and seeing that shot and the way it was placed, and seeing the joint at the back of the hole (which evidently prevented it from spreading) would come to the conclusion that the shot was not under-charged but over-charged.

6436. Was the strata broken off at this parting?—Yes.

6437. But the powder was laid beyond the parting?—No, the parting was 3 inches beyond the back of the hole.

6438. Beyond the back of the hole?—Yes.

6439. Then in that case the débris was blown down?—Was blown from the joint or parting.

6440. Then you say the hole was beyond the joint?—No, the joint was beyond the hole. It was 3 inches beyond the back of the hole.

6441. I think you said that the increased ventilation had something to do with the explosion?—It has made an increased dryness in the roads which has been very evident—more so since our attention has been drawn to it since the explosion. We can see it more plainly than we could before.

6442. Do you consider that an increased ventilation in a mine is an additional source of danger?—I think it is as far as the coal-dust explosions are concerned. It would seem to be so. I may say that this road, when I first came to the pit was the return air-way, and there was not then so much ventilation and the road was in a very damp state and anything but dry and dusty; but since we have made it the intake and more air has gone in it is much drier and much dustier.

6443. I think you also said that the reason why you do not use high explosives in the face is because at the face you have a considerable quantity of moisture. Would you say that where such conditions do not obtain gunpowder at the face should be prohibited?—Do you mean as to moisture only, because one of the reasons why I say it is safe to use gunpowder at the face is on account of the large amount of shale that is present with our seams? That would not apply perhaps in other cases. It applies to our case, but it would not apply, generally speaking. Our thickest vein of coal is only 2 feet and the thinnest is 1 foot, and averaging it over a period we send out one load of shale to four of coal, in addition to packing the vacant space as full as we can get it, so that there is a large amount of shale mixed with any coal dust that may be present at the face as well as the moisture.

6444. Do you work on the long-wall system or on the bore-and-stall system?—On the long-wall system.

6445. I understood you to say, in answer to a question of Sir William Lewis, that you packed closely between your gateways; is that so?—As I say, in most instances the stuff is more than sufficient to pack it closely; in some instances there would be a little vacant space. The men hole underneath the coal in the shale; they do not hole in the coal, and the shale in most instances from the holing is sufficient to fill the vacant space between the pack walls.

6446. If it is not sufficient you do not import any to fill it up?—Not as a rule.

6447. (*Professor Dixon.*) You said that the depth of the shot hole is 10 inches, and that it is within 3 inches of a fault; in your opinion had the fireman observed that fault?—It is rather difficult to say, but I should think not.

6448. If he had noticed it would he, in your opinion, have bored his hole in that position?—No, I do not think he would.

6449. Is such an occurrence as this, the production of a large flame in a dusty place, a very rare occurrence?—In our pits?

6450. Yes?—It is, especially with the smaller holes.

6451. I mean is a blown-out shot or a shot of this kind which did not do the work intended, and therefore which produced a large flame, a rare occurrence?—Yes, I think it would be.

6452. In your experience?—I think it would be a rare occurrence.

6453. In the falls of roof that occur would you expect to find gas in any of the cavities so formed if there was any gas in the strata?—I think my answer to that is that there was no one at the pit who at all expected to find it anywhere in our pits. I and others have been everywhere about the pit with air and without air, over falls and up faults, and we have not found any gas, so that none of us expected to find any.

6454. Speaking from your experience of other pits, after the explosion would you have expected gas to accumulate in the cavities of the roof where the falls occurred?—I could hardly say after the explosion.

6455. If there was any gas present I mean?—I am not quite clear on that point whether you would or would not. The air that was passing went over the top of the falls after the explosion, and it is possible that it might clear out any gas which was there; the current of air travelled near the roof after the explosion.

6456. Were there cavities in the roof?—There were some cavities, and I should have expected to find gas in those where they were a considerable height above the air current if any gas had been present.

6457. There were such cavities?—Yes.

6458. You say you think the mine is rather more dusty now than it was some few years ago?—As far as this district is concerned, I certainly do think so.

6459. How long have these trams with the open ends been employed?—More or less during the whole history of the colliery. At one time I understand they used to use some loose boards to put in the end, but I do not think that that was carried on for any length of time. I mean to say that it would not be general; it would only be occasionally that they were used.

6460. As long as your experience extends, have they always used those open ends?—As long as my experience extends—for the last nine years—they have been open ends; and previously.

6461. I suppose that was for the convenience of putting the coal in?—It is principally on that account. It is convenient to put the large blocks of coal from the low seams in like that. I may say in connection with that, that I think of late years the men and boys in the working places have loaded up a considerably greater quantity of small coal than they used to formerly. That is shown by the books of the colliery. They use the shovel more in the heads, but formerly that was prohibited.

6462. Would that produce more dust?—Yes; there would be more leakage at the open end the more small there is; if the coal is hard or block, the less leakage there would be.

6463. Mr. Martin I see speaks of the grinding of the coal; does he refer to the grinding of the mass of the coal in the tubs, or to the coal piled up in the tubs striking the roof?—I think he was referring to the grinding against the roof. The roadway was low at that point.

6464. That did actually occur?—Yes.

6465. To your knowledge?—At that point; that was the reason the men were there, to make more height. That would be Mr. Martin's meaning, I think—grinding against the top.

6466. Then with regard to the effects of the explosion, the candles were found, I think, standing upright, and not much damaged?—There was a sharp-pointed end to the candlesticks, and the candlesticks were stuck in the sides. The sharp-pointed end was simply pushed into the loose stuff (which is frequently done) and there they were found intact.

6467. The candles themselves were not bent or upset, were they?—I could not speak positively upon that point. I am not certain whether one of the candlesticks was not changed before I saw them. I took particular notice of it; but as far as I know, they were not bent.

6468. Have you marked on the plan of the pit you have brought to-day, where the moisture begins going out-bye from the pump corner?—No, that is not marked there, but I can give you the distances. For 156 yards outside the pump corner towards the pit there is no dampness, and dust is prevalent. Beyond this, there is water and mud in the roadway, and for some distance the top yields a little water. On this last length the disturbance ended, the whole length of this mixed wet and dry roadway being 53 yards.

6469. Does that take us up to the first fall, or is the first fall further out than that?—The first fall would be just beyond that. The last two falls are in that 53 yards of roadway.

6470. Did you notice what was the greatest length of damp roadway that the flame leaped over?—That would be the greatest distance of absolutely damp roadway—that 53 yards.

6471. But there it appears to have stopped?—There it stopped.

6472. Previously to the flame reaching that point it had gone over one or two places that were damp, had it not?—Yes, from the bottom of the incline; which is 311 yards from the shot to the dipple, which is marked on the plan distant 474 yards from the shot; that would be slightly damp I should call it—not so dry and dusty as the other. A little water was lying at the bottom of the incline 311 yards from the shot, and for 160 yards from thereout the road would be somewhat damp.

6473. I am speaking of an actual puddle or moisture lying on the floor?—There would not be anything of that kind except these 53 yards of which I am speaking in which the last two falls occurred.

6474. (*Sir W. Lewis.*) That was the termination?—Yes.

6475. (*Professor Dixon.*) It was near the termination at any rate?—Yes.

6476. There was no actual wet length to which you can refer in your memory that the flame must have leaped over except this place near the bottom of the incline?—There was nothing actually wet and muddy, except this place near the bottom of the incline. There was a little water just at the bottom of the incline. I do not know whether it was in consequence of this, but at that point there were no falls, and the timber was not knocked out.

6477. But there was some charring near that point?—There was some charred dust nearly over some loaded trams of coal that stood there, and part of the coal was blown out of the tram, which accounted for the charring.

6478. Your opinion then is that the coal standing in the trams would yield some dust?—Yes.

6479. And so carry on the explosion?—Yes; that is my opinion.

6480. Then with regard to this worked-out coal, can you get any distance into that old road, or could you at the time of the explosion get any distance into that old road, which is just before you reach the shot, going in?—Yes; a man was in there with a naked light some few hours before these men went to work, and they themselves were in there putting some of the débris from their first shot in there.

6481. Stowing it away there?—Stowing it away.

6482. Did they stow the débris of the first shot in there?—Yes.

6483. They would go in with their candles then?—Yes.

6484. So that within an hour or an hour and a half men with naked lights had been into that old road?—That is so.

6485. So that any gas there must have been detected?—Yes.

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6486. (*Lord Raleigh.*) You told us that in all your experience of the mine you had no knowledge of any gas being found there; since the explosion have special tests been made as to the presence or absence of gas?—Yes. Professor Dixon has, I think, made some tests, and Mr. Martin, and Mr. Stokes, with his lamp, have made tests. Mr. Martin has been down two or three times, and made some special tests. He had the workings closed up for some 10 days, and after that he came and very carefully tried it with a safety lamp.

6487. Mr. Martin is the inspector? — He is the inspector of our district.

6488. (*Professor Dixon.*) Were you with him when he went down?—Yes, I was with him.

6489. Would you tell us on this plan where the stoppings were put after the explosion?—A stopping was put just inside the dipple, which stopped the intake air.

6490. Robert's dipple?—Yes, just inside the dipple. The other stopping was put in the return airway. I do not think I can give you any particular point. It was actually *here*, but it was put somewhere *there*.

6491. Would you show it me on my plan?—Certainly. [*The witness marked the position on the plan.*]

The witness withdrew.

Mr. J. Brown.

Mr. JOHN BROWN called and examined.

6492. (*Chairman.*) You are an examiner and fireman in the Camerton Colliery, are you not?—Yes.

6493. Do your duties lead you to the part of the colliery where the explosion took place?—Yes.

6494. It is on that district that you are acting as examiner?—Yes.

6495. What time were you there before the explosion?—About 12.30 in the day before—on the 13th.

6496. And the explosion took place about 12 o'clock at night?—At night.

6497. What was the condition of working at the time you were there?—All safe and the ventilation good.

6498. You do not examine for gas I understand?—No, never did there.

6499. Was there much dust there?—Yes.

6500. How much dust should you say?—I could not say exactly how much, but I know there was the incline being altered from a double run to a single run. By doing away with one run that allowed space on each side of the rail, and we had to clean up from the rails that were there and throw it at the sides until it was convenient to fill the tubs with it and take it away.

6501. Therefore there would be an amount of dust on each side?—Yes, a bank of dust on each side. It is not often that we have got room on each side of the rail to throw anything, so that there would have been more dust there than there could have been if there had been two runs.

6502. How long have you been working in this colliery?—21 years on the 13th of this month.

6503. Have you ever known any gas to exist there?—I have never seen any there.

6504. Do you think there could have been any gas at the time of the explosion?—No, I do not believe there was.

6505. How quickly were you on the spot after the explosion?—It was not before mid-day when I got there.

6506. Then did you examine the shot-hole?—Yes.

6507. And you found, I understand, a joint at the back of the hole?—Yes there was.

6508. How much powder do you think had been put in?—As I judged myself I should think seven or eight inches.

6509. Seven or eight inches of powder?—I should think there was.

6510. What would be the usual charge for a hole of that size, how much powder would they put in?—I could not say much about that one, for I should never put a hole there and I should have no judgment on the hole at all. If I had made a hole there I should have bored another one and never done anything with that.

6511. That is to say you would have found the joint there?—Yes.

6512. And you would have made a hole in a different place?—Yes; if I had not seen the joint I should not have bored a hole there. It was a mistake in judgment somehow or another.

6513. Do you think the powder blew out?—Yes, I think it did.

6514. It did bring down some rock, did it not?—Yes, a little.

6515. How much did it bring down? — Perhaps nearly a hundredweight.

6516. Did it bring down up to the joint?—Yes, to the joint.

6517. But it did not shake the joint, or go beyond?—No, not beyond.

6518. Was the part of the mine where the explosion took place more than usually dusty?—Yes, that was. It was rather more so than we had ever seen. The reason of it was that the loads travel fast there, as the bottom half of the incline is so much steeper than the top; then there are four loads at a time, where we do not as a rule run but two anywhere else in the pit; then there was a little more air going, so that when the load is run through at that particular point it would cast such a dust behind that you could scarcely see or come through it for a few seconds.

6519. I see that before the coroner you said that you had noticed nothing unusual in the amount of dust?—No, that had been carrying on ever since the incline had been put into the run like it is now.

6520. How long is that?—About 18 months.

6521. Therefore, during the last 18 months there has been always a great deal of dust there?—Always dust there.

6522. Do you know whether there has been any previous blown-out shot in that neighbourhood?—No, I have been there all through it. We would bore some days two, and some days three holes, but they were hand-drilled ones.

6523. Do you have many blown-out shots?—In the face we do very often.

6524. And in the rock?—Yes.

6525. You do?—In the rock and in the face.

6526. Are the faces dusty?—No, there is a moisture and all that, and a sweating in the top.

6527. They are always damp, are they?—Yes, in those districts and through the pit there will remain a moisture from 20 to 30 yards back, and then after that drying will begin.

6528. When you examined the workings afterwards did you examine them with the naked candle?—No, with a lamp.

6529. Was it a safety lamp?—Yes.

6530. Was that the day after, do you mean?—On the 16th I started it for gas with the locked lamp and followed on to the 24th every day.

6531. Did you find any gas?—No, nothing.

6532. (*Professor Dixon.*) Was that a Davy lamp?—Yes, I found some coke handy where the shot was fired. It has rough walls there, and in amongst that I found a bit of dust burnt into coke.

6533. When did you first get into the incline after the explosion?—On the 14th. I was not forward enough to be of the company that found the bodies, but I was just behind.

6534. Did you notice the men's candles in the refuge hole?—Yes, I saw one there.

6535. Was it damaged?—No.

6536. Was it standing upright?—Yes, except that the wick of the candle was drooping.

6537. (*Mr. Fenwick.*) Why should you, if you had been in charge of that job, not have placed your shot where it was?—Because it would have been against my judgment.

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6538. What circumstances were there that would have led you to that conclusion?—Just above there was a hollow in the roof and it could have got there. In my experience of powder in blasting I always find it to do more work down the hill; it will take better in blowing down the hill. So, if I had been there, that is how I should have advised them to put it. Then there was what I have never seen ever since I have been in the habit of using powder, and I have used a good bit. They commenced the hole from nothing and bored ten inches, letting it go up ten inches. They should have begun at nothing and slanted it more.

6539. Do you mean to say that the hole rose too rapidly?—Yes, that is what I say.

6540. Was it far from the side?—From the side of the road do you mean?

6541. Yes?—It was put in the centre of it.

6542. When you changed the run in the incline from a double to a single line, did you put the run in the centre?—No, we put it as true as we could for the rail to be straight. At some places it would come handy for it to be on one side, and at another time it would come in the middle, and at another time on the other side. We put it on the straight, because it had to run so fast.

6543. You found some considerable inconvenience from the dust that accumulated on the incline, did you?—Yes.

6544. Do you think it would be true to say that you had to fill up from one to two trams a day from the incline?—No, I should not say that—I should say four a week, as I very often do it myself.

6545. Are you aware that Mr. Martin says that in his report?—Yes, I expect so; it was what I said myself.

6546. Then you think the report is not strictly correct, then?—I say there was not one or two a day, but I say there were four to five a week.

6547. (*Sir W. Lewis.*) Have you seen gas in any other colliery than this?—Yes.

6548. Where?—At Blaina, South Wales.

6549. How long did you work there?—A year and 10 months.

6550. Was that before you were appointed fireman at this colliery?—Yes.

6551. Had you any acquaintance with testing for gas at Blaina?—Yes.

6552. As a collier?—Yes, as a miner.

6553. And you worked there with a safety-lamp?—Yes.

6554. So that you would know gas when you saw it?—Yes, I should know that.

6555. You said there were 7 inches or 8 inches of powder put in this hole, and that that was too much; how much would you consider sufficient for such a hole, even if you would put it there at all?—If it had done its proper work that it was intended for I should think 2 inches would have been plenty from what I could see of that.

6556. Instead of 7 or 8 inches?—Yes.

6557. I also understood you to say that instead of putting the hole *there* (*pointing to the plan*) you would have put it *here* and worked *this* way?—Yes, that is it.

6558. Did I understand you aright to tell the Chairman that there was more dust there than was usual in your colliery in consequence of the change which you said had been made there?—Yes, that would be through the change.

6559. You said that there was a bank of dust on each side?—Yes.

6560. And that is unusual in the other places of the colliery?—In other places of the work you would never find room to do it.

6561. Have you had much experience yourself in shot firing in that colliery?—Yes.

6562. Both on the main roads and in the face?—Yes.

6563. Have you ever seen a blown-out shot?—Yes, I think I see them every week now.

6564. On the main roads?—In the face, not on the roads.

6565. You have never seen a blown-out shot in the main roads?—I do not know that I have noticed them on the horse roads or that. We should hardly ever fire any out there.

6566. Where you have had a blown-out shot in the face have you ever had any accident?—No.

6567. But there you told the Chairman that the place is damp?—Yes, it is.

6568. And that the small coal is mixed with shale?—Yes, that is true.

The witness withdrew.

Mr. Joseph Samuel Martin called and examined.

Mr. J. S. Martin.

6569. (*Chairman.*) You are one of the Inspectors of Mines, I think?—I am.

6570. And you have had a good deal of experience of explosions?—Yes.

6571. In what districts?—In the East Lancashire or Manchester district, in the South Wales district and the South-western district.

6572. Have you given any attention to the question of coal dust as an agent in explosions?—Yes.

6573. What has been your opinion hitherto?—I have been of the opinion that it has had the effect of extending explosions, but until comparatively recently I have not been of the opinion that it was an agent which would, you might say, cause an explosion.

6574. Have you recently seen reason to change your opinion?—Yes.

6575. What has been the cause of that change?—In the first instance the explosion or rather the extension of flame from an explosion in blasting which Mr. MacMurtrie has explained to you; it occurred at the Ludlow's pit at Radstock in, I think it was, November 1891; subsequently experiments made by Mr. Hall; and then recently an explosion which occurred at the Camerton Colliery in the Radstock coalfield.

6576. Dealing first with the explosion in the Radstock Colliery, was that in your opinion an explosion entirely due to coal dust?—I have no doubt about it. Of course it was an explosion of gunpowder in the first instance. They were blasting, and the extension of the flame was due to dust.

6577. But in your opinion there was no gas on that occasion?—None.

6578. The latest of these explosions is the one at the Camerton Pit?—Yes.

6579. In that case have you any doubt as to the cause of the explosion?—Not the slightest.

6580. To what do you attribute it then?—To a shot fired in the roof igniting dust, which lay on the floor and perhaps to some extent at the sides.

6581. Are you convinced that gas played no part in that explosion?—Fire-damp played no part whatsoever; whether gas was distilled from the coal dust, of course I am not prepared to say.

6582. But you are of opinion that there was no gas in the workings previous to the explosion?—Certainly.

6583. What are the grounds upon which you base that opinion?—The mine itself has been worked for about a century, during which time fire-damp has been totally unrecorded and unknown. This series of seams, that is the upper series of the Radstock or upper division of the Somersetshire coalfield, has never been known to give off fire-damp in any part of the coalfield.

6584. How long was it after the explosion that you visited the pit?—About 16 or 17 hours.

6585. Did you then make any examination for fire-damp?—I went with a naked light to the point where the shot was fired. About 2,100 yards from the shaft.

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6586. Did you find on that occasion any trace of fire-damp?—None whatever. Safety lamps were totally unknown at that colliery previously, and I asked the manager if he had a safety lamp in order to go forward, but he had none. Then I asked him that the next morning he might have them so that we might go into the faces. I did not feel justified in going forward without safety lamps. The next morning he had safety lamps, having sent to a colliery about seven or eight miles away, the nearest at which safety lamps are kept. We then went into the faces of the workings and found no trace whatsoever of gas.

6587. Did your examination of the mine show how far the explosion had extended?—The roads were damaged to a point within, I think it was, about 700 yards from the shaft. I have a plan here. The shaft was *here* and *this* is the road in. The outside fall, I think, was about 760 yards from the shaft.

6588. How far distant was it from the explosion?—About 1,350 yards from the seat of the explosion.

6589. Was there any evidence as to where the force of the explosion was greatest?—From about 200 yards from the seat of the explosion right away to the pump corner.

6590. (*Sir William Lewis.*) Right back?—Right back.

6591. (*Chairman.*) To the pump corner?—Yes, which would be a distance of a thousand yards.

6592. Was there anything to account for the failure of the explosion from that point?—There was a certain amount of dampness alternating with a smaller amount of dust.

6593. In the other part of the road was there any evidence of a considerable quantity of dust?—Yes. So far as I am aware the only point between the pump corner and the seat of the shot where there was any damp was at the bottom of the incline, which would be about 350 yards from the shot. There was water on the flat sheets at the bottom of the incline, and it would be damp for a certain number of yards—30 or 40 I believe—from that point.

6594. How do you imagine that the explosion got over that damp part?—There were some tubs standing with coal just on the outer side of that damp part, and in my opinion the force of the explosion caused some of the coal dust on those trams to be disturbed and it becoming ignited carried the flame further out to where dust again existed on the roadway.

6595. Was the shot which caused the explosion an overcharged shot?—For the work that it did it was an overcharged shot.

6596. There was very little rock brought down by it, was there not?—A very small quantity.

6597. Have you had any other experience of explosions which could not be traced to the existence of fire-damp?—About 25 years ago when I was connected with a mine in Germany (Westphalia) we had an explosion in which I think it was six or eight men lost their lives—I forget exactly the number. Although the stoppings were blown out and they were not replaced for several weeks no trace of fire-damp was found in those workings. At the time it was considered to be an explosion of fire-damp as the seams generally in the colliery gave off fire-damp. It was a dusty coal, and going back as far as memory will permit me, I should now be inclined to think that dust was probably in a great measure the cause of it.

6598. Did you take any steps after the explosion at Camerton to test the mine for fire-damp?—I accompanied Professor Dixon, Mr. Stokes, and Mr. W. N. Atkinson, two of my colleagues, in the mine, and we tested, with Professor Clowes' hydrogen lamp, and also with Mr. Stokes' patent lamp, but we found no trace of fire-damp in the air, not even the minutest particle. Subsequently the ventilation was cut off from the whole of that district (above the bottom of the incline), and it remained shut off for about a fortnight. When opened I was present at Professor Dixon's request, and a good deal of black damp was given off, but there was no indication whatever of fire-damp.

6599. Then I understand that it is your opinion that this was purely a dust explosion?—In my opinion entirely so.

6600. Therefore you would say that there is danger of such an explosion even in a mine in which no fire-damp has ever been known?—That is so, distinctly, since this explosion.

6601. What extra precautions would you recommend to be taken to meet this danger?—In the first place I should prohibit the use of powder, which I consider is the most dangerous explosive. Although the high explosives are not actually flameless, some of them (which as nearly approach it as possible) should be made use of.

6602. Would you allow no exceptions to the prohibition?—In consequence of the possibility or likelihood of its being used where it ought not to be I should be inclined to go the full length and prohibit it.

6603. Would there be any inconvenience to the mine-owner if he were prohibited from using powder?—I am not prepared to say exactly whether the expense is greater or not, but I believe some of the present explosives would otherwise effect the object without inconvenience.

6604. The only difficulty that you foresee would be one of cost?—Yes, and that would be very trifling, I should think.

6605. Have you had any experience of watering mines where considerable quantities of dust prevail?—Yes.

6606. Do you think that is a necessary precaution?—Yes, I think it is a highly desirable and necessary precaution, but I do not think that it is totally effective. I do not think that a mine can be so thoroughly watered as to render it safe by watering alone.

6607. In the case of a mine where fire-damp exists, and where an explosion of fire-damp may be initiated either by one of the high explosives or in some other way, and may then be continued by coal dust, is there any precaution which could be taken except to water—I am assuming that high explosives are used in such a mine already?—I think the number of persons employed ought to be limited to a minimum, so that in case an explosion did occur the loss of life would be as small as possible. I think the shot-firing ought to be done by some competent and responsible official, and as far as practicable, by electricity instead of by fuse.

6608. When you say as few people should be employed as possible, you mean, I presume, at the moment of the shot firing?—As few people as practicable should be in the mine at the time of blasting.

6609. Do you think, consistently with the efficient working of the mine, the shot firing could be carried out on that principle?—It was done so in the Manchester district when I was in that district.

6610. The shots took place before the general working began?—All shots were fired in such mines between the shifts or after the men had gone out.

6611. Does that cause no delay in the working?—It was found to be practicable there.

6612. (*Sir William Lewis.*) Referring to your report, which has been confirmed by the evidence we have had this morning, it appears that a shot had been fired a couple of hours before the shot which may be described as having been fatal?—It appears to have been the case.

6613. How do you account for that shot having been fired without any disastrous results, while this shot under practically the same circumstances created an explosion?—That is one of those things that I do not think can be explained. If one takes the large number of shots that are fired in the mines in the kingdom, and the small number which ultimately result in explosions, it can only be that the circumstances were exceptional and just such as to suit the occasion. I can in no other way account for it.

6614. What could have been exceptional, assuming that the dust was on the roads and on the sides at the time of the first shot? That shot was fired without any disastrous results, and two hours afterwards a shot was fired in the immediate neighbourhood with the fatal effects that you and other witnesses have described. How do you account for it?—The difference between the two shots of course is that the one did its work, and that in the case of the other, the work was reduced to a point below what it was intended to do in consequence of a joint in the roof which cut it short.

6615. Is that the only difference that your practical experience can suggest to the Commission?—Yes, that is the only point which presents itself.

6616. The difference between a shot that has done its work and a shot which may be described as a blown-out shot?—It is not a blown-out shot.

6617. I will refer to your report, if I may be permitted to do so. "The shot-hole was commenced a

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" foot on one side of the centre of the incline and about " seven inches up in the roof, but it rose about four it " five inches more in its length of ten inches, and to " was evidently intended to rip down a length beyond " the end of the hole, but was cut off from doing so by " a joint three inches beyond which Hawkins must " have failed to notice. The result of this joint was " that the hole, otherwise a very short one, was with " half to three quarters of a pound of powder over- " charged." In other words that is a blown-out shot —It did not do its work: it was charged beyond what was necessary for the particular work intended?—It blew down to the full length of the hole.

6618. Did you examine the hole as to the amount of powder that was in it?—It is fair for me to tell you that the evidence we have received from the fireman was that there was 7 or 8 inches of powder, and that it was more than twice as much as he would put in —he said about 2 inches, I think, and Mr. Garthwaite said about 4 inches; what do you say?—That is what I consider would have been about in the hole.

6619. What?—About the 4 inches; that is the calculation I made there, that about 3½ to 4 inches of powder in the hole would make from about half to three-quarters of a pound.

6620. I wanted to draw a distinction between a shot doing its work and a shot such as you have described as being an overcharged or a blown-out shot?—It is an overcharged shot for the work that it did, but not for the work that it was intended to do.

6621. Did it or did it not blow out?—No, it blew down to the end of the hole, and 2 or 3 inches beyond it.

6622. Did it also blow out so as to ignite the dust—that is your suggestion, that it ignited this dust, and that that was the cause of the explosion?—That is the only explanation I can give. This plan will show the position.

6623. The Commission have had before them a section showing the position of the previous hole—that was *there*, was it not (*pointing to plan*)?—Yes.

6624. That was set off two hours before?—It was explained to me so.

6625. There was dust on the bottom and dust on the sides as described by previous witnesses when the shot was fired; how do you account for that shot not firing up this dust if dust was the cause of the subsequent accident?—I cannot explain it any further, than that the flame did not catch it as it were at the point suitable for the purpose.

6626. Do you think it is possible that the first shot may have relieved any gas from the strata, either above or below the seam?—No.

6627. And that that was set fire to by the subsequent shot?—No, I am perfectly satisfied in my own mind that fire-damp has had nothing whatever to do with that explosion at Camerton. I was very sceptical of it until after I had investigated the whole thing. One of the first things I said to the manager on going down with naked lights and going into the workings 2,100 yards, was that I thought it was exceedingly reckless.

6628. To work with naked lights?—To have gone in straight away after the explosion with naked lights.

6629. Did you inquire as to how frequent blown-out shots were in that colliery?—I think I heard that they occurred very seldom—that they were rare.

6630. Rare in the main ways, or rare in the faces?—I understood generally.

6631. You did not ascertain whether there were more blown-out shots in the faces than in the main ways?—No, I did not. There has not been, I understood, a great deal of blasting in the main ways.

6632. In reply to the Chairman, you said that flameless explosives only should be used; would you lay that down without reference to the quality of the dust or the extent of the dust in the particular vicinity of the shot that is about to be fired?—If dust were present I certainly would.

6633. Without reference to the inflammability of the dust?—Yes.

6634. You would draw no distinction between the dust of one seam and the dust of another seam of coal?—No, I think not.

6635. Would you draw any distinction between dust pure and simple, and dust mixed with fine shale?—No, inasmuch as if you allow it to be left to anyone's judgment, then the difficulty at once creeps in as to drawing a distinction; and again, if I remember correctly, I have seen the extension of flame with a dust which was non-combustible.

6636. (*Chairman*). You said non-combustible, but I suppose you mean non-fiery?—Non-fiery.

6637. If it was in flame I suppose it must be considered to be combustible?—It extended the flame; it was an experiment of Sir Frederick Abel's with calcined magnesia.

6638. (*Sir William Lewis.*) You are referring to dust mixed with shale, and to dust of pure coal?—I would not draw any distinction between those two

6639. So if you had an explosion, such as this is alleged to be, in the main way where there is dust pure and simple, and you had blown-out shots in the faces where they say the dust is mixed with shale, and without any accident, you would still think it was necessary to take the same precautions in the face as in the main ways—that is what I understand?—With fine dust, yes.

6640. With fine dust without reference to its being shale and coal, or simply pure coal dust?—Yes, I would.

6641. Now with respect to the continuation of the effect of the explosion; you told the Chairman that the explosion was extended by reason of there being a number of tubs of coal with dust upon them in that wet place at the bottom of the incline; do you think that if that train of tubs had not been there the explosion would have been extended over that wet place?—I am not prepared to say that it would or that it would not; I rather think that if it came down there as it must have done with a good deal of force it probably would have extended; but directly over the end of one of those tubs was found against the roof on some of the timber a quantity of charred dust sticking to the timber. That was one of the few places where charred dust was found on the timbers.

6642. Have you considered the matter sufficiently to be able to tell the Commission what extent of damp place you think such an explosion had leaped over as it were?—I have not got sufficient data to be able to give a definite opinion upon it.

6643. I do not know whether in answering the question of the Chairman with respect to the watering, you had in your mind the various improved arrangements for watering which have been introduced into the steam coal collieries in South Wales—they are partly in your district and partly in Mr. Robson's district?—Yes, I had got them in my mind. They are perhaps the most efficient watering arrangements that there are in mining; but they do not lay the dust completely.

6644. I was going to ask you that question. Have you anything to suggest that can be done beyond what is being done in the South Wales steam coal collieries with respect to laying the dust or moistening the intake air in the way, say, that it is done at Bedlinog?—No.

6645. We have had evidence of it from Mr. Martin and others?—I think the Bedlinog arrangement is very effective.

6646. (*Chairman.*) That was sprinkling high-pressure water, was it not?—Water with compressed air.

6647. (*Sir William Lewis.*) You have nothing to suggest to the Commission as a better arrangement, or anything that you would require more than that?—No, I think that is as effective as it can be; but I think it is impossible to thoroughly damp the whole of a mine practically.

6648. Then assuming that that arrangement were introduced into the whole of the mines, do you still think it necessary to prohibit the use of gunpowder?—I should prohibit the use of gunpowder entirely.

6649. Notwithstanding the moistening of the air?—Yes.

6650. Would you do that both on the roads and in the face, assuming that the dust in the face was mixed with a very large proportion of shale, as is generally found in the face of this coal?—I think in practice it would be desirable to do so throughout.

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6651. Have you had any special experience with these flameless explosives; have you satisfied yourself that what is described as being flameless is really so in practice?—No; I am not satisfied that these explosives are flameless, but they are very much safer in that respect than powder is. My suggestion to the managers in my district is: avoid that which is known to be the most dangerous, and make use of some of those which will reduce the danger to a minimum.

6652. Then do I understand that you would not go beyond the abolition of powder—you would simply abolish powder and let them use any other explosives than powder; is that it?—I have no power of going beyond that.

6653. It is not a question of power. I am asking you your opinion; you have given this matter your consideration, I have no doubt, and what I am anxious is that the Commission should have the benefit of your experience?—In the very fiery mines if blasting is actually necessary, then I would suggest that it should be done when the number of persons employed in the mine is a very small number, so that the risk of life should be as small as possible.

6654. That I understood from your answer to the Chairman; but I want to go further. Does your suggestion to the Commission go beyond that of abolishing the use of gunpowder?—I do not quite understand you.

6655. Have you any particular explosive that you, from your experience and from moving about the collieries in the district now under your control, consider can be used with the least possible risk?—No, I do not lay myself out to recommend any specific explosive. I may say that since the explosion at the National Colliery I do not like the water cartridge with dynamite.

6656. But whether it is one explosive or the other your opinion is that the risk would be considerably reduced by firing shots by electricity instead of by fuse?—Yes, I think that it would be reduced.

6657. (*Mr. Fenwick.*) Do you happen to know what time elapsed between the firing of the first shot and of the second?—It was merely described to me. The information as to that shot was arrived at from the fireman informing us that from the time the men had gone to their work, or the time that he had been there on the previous day, that shot had been fired and the rubbish had been packed away. We have no information as to the exact time that elapsed.

6658. Supposing two hours had elapsed between the firing of the first and of the second shot, do you think it was possible for the first shot in any way to have started the dust in the neighbourhood of the shot?—Which would affect the second one?

6659. Which might have been in suspension when the second shot was fired?—I do not think so.

6660. With regard to watering, do you consider that the rule relating to watering is generally observed in your district?—I do not think there is much watering done specifically with regard to blasting.

6661. May I take it that that is due to the fact that fire-damp has not been found in those mines?—In those mines in Somersetshire, in the non-fiery mines certainly, watering has not been carried out.

6662. I think you said also that where shot-firing is absolutely necessary it ought to be done at a time when there are the fewest possible persons employed in the mine, and you also told us in answer to a question by the Chairman that in Lancashire this practice had been found to work very well; but is it true that they have a single shift in those districts?—No.

6663. Is it a double-shift system?—Yes. May I explain. Under the 1872 Act, I forget the exact wording of it, if fire-damp were given off so as to show a blue cap on the flame of the safety lamp, shot-firing could only be done when the persons ordinarily employed were out of the mine. I think if I remember correctly that is about the wording of it. In Lancashire in the Manchester district, of which Mr. Dickinson was in charge and in which I acted for 12 years as an assistant, that was practically carried out.

6664. With the double-shift system?—With the double-shift system, and also where they had the single shift; it was done in both.

6665. Is there any danger, may I ask, of an inconvenience arising to either employers or workmen of not being able to get coal, providing that you have to withdraw a number of men before you can fire shots?—I can only say that in that case they overcame it; they were able to make arrangements which allowed of its being done. The present Act is not worded in the same way.

6666. (*Sir William Lewis.*) Does that not depend very much upon the extent to which powder or other explosives are required in the getting of the coal?—In some of the collieries there they blast a good deal.

6667. But does your answer not depend very much upon the extent to which explosives are required. There are collieries where there are very few shots required, depending either upon the nature of the coal or the ripping of the roof, or the cutting of the bottom; there are other collieries where the coal requires blasting, where the seams are thin and the top is hard, and the bottom also is very hard, and where a very large per-centage of the work of the collier requires blasting; would that, or would it not, make any difference in your answer?—It would make a difference in the question of convenience distinctly.

6668. Your answer to Mr. Fenwick with reference to the Somersetshire portion of your mines as to damping, I take it, would not apply to the steam coals of Monmouthshire; you would not give the same answer that there is no damping of or moisture in the air in accordance with the Act of Parliament in Monmouthshire?—There is not a great deal of blasting, I think, in the dry and dusty mines carried on during the shift.

6669. No; but as regards the moisture of the air in accordance with the Act of Parliament in Monmouthshire, it is done to a greater extent than it is in Somersetshire?—Yes; but I may say that in the Black Vein workings, in which a large number of explosions have occurred, in the neighbourhood of Risca and Abercarn—in that neighbourhood blasting is not carried out at all—there is no blasting done. In some of the mines which have been lately opened the question of blasting has arisen, and some of the managers have seen me about it, and it has been restricted very much.

6670. Is there any watering done?—Yes, to some extent.

6671. (*Professor Dixon.*) Would you call this place where the shot was fired dry and dusty?—Yes.

6672. Now?—Now.

6673. Speaking after the event, that is?—After the event.

6674. Before the event you would not have done so?—I am not prepared to say. I was not acquainted with the place before. The part of the same mine which I had personally inspected was very wet.

6675. In your opinion does it come under this section F., rule 12, as a dry and dusty place?—Yes.

6676. So in your present judgment a shot ought not to have been fired there?—That is so, without watering, or an explosive being used which would not fire the dust.

6677. What is your definition of a blown-out shot?—In which the stemming is blown out and the shot-hole remains unimpaired.

6678. Would you describe the hole as it was found?—The one half remained in the roof and the other half of the hole was blown away.

6679 It was opened up then to at all events one-half its length?—One-half of its circumference. It was blown down for the full length of the shot-hole, but half of the circumference remained.

6680. (*Sir William Lewis.*) That is to say a semicircle?—That is so.

6681. (*Professor Dixon.*) My recollection of it is this: that the rock below was blown down to the full length and even beyond the shot-hole?—Three inches beyond, to the joint beyond.

6682. Therefore it was not a blown-out shot according to your definition?—No.

6683. Is it possible to tell exactly how much powder was in the hole?—No; it can only be taken from analogy, you may say.

6684. Sir William Lewis asked you whether there was any difference between the two shots to account for the first not firing the dust, and the second doing so. From your knowledge of firing shots in coal mines would you not say that when little work is done there

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is always more flame than when more work is done?—I understood that I had explained that to be my view—that in the one case the shot had done its work, and the flame would not be as great as in the other case where the amount of work which the shot did was so small that a large body of flame arose from it.

6685. There must have been much more flame in the second case than in the first?—Very much I should think.

6686. And it is to that difference that you attribute the explosion in the second case?—That would be what I intended to convey.

6687. Can you tell us by any measurements that you have made what length of damp road was jumped over anywhere by the flame?—Not by measurements of my own.

6688. Of anyone else's?—At the bottom of the incline there was water on the flat sheets, and I was told that the distance that would be damp was about 30 yards. I think that is mentioned in my report.

6689. But there was a special circumstance there, namely, the presence of coal in tubs?—Yes.

6690. Which might have accounted for the flame passing over it?—Which I consider assisted in carrying the flame forward.

6691. But now coming further out beyond the pump corner there were some patches of damp road there?—Between the pump corner and the horse gug, there were, I think, three wet patches.

6692. Can you give us the length of those or any one of them?—I think I remember stepping one of them somewhere between 30 and 40 yards.

6693. That was thoroughly damped?—Yes.

6694. Wet under foot?—Part of it was wet under foot. It would be then damp on either side without dust.

6695. And in your opinion the flame must have gone over that damp place?—I cannot speak with regard to the flame. I think that consumed dust was conveyed past it, judging by the film of dust which I saw lying there when I arrived, but as to the actual fact of flame having passed I have nothing to guide me.

6696. How far, in your opinion, did the flame extend outwards?—I have here some of the dust (*producing specimen*). This was sent to me by Mr. Atkinson; it was taken up at the time of our inspection at about 100 yards on the inner side of the pump corner, and when examined under the microscope (which I did this morning) it clearly indicated a globular condition as though it had been coked.

6697. May I correct you for one moment. Did you not refer to inside the horse gug?—No, that was collected half-way between the branch and bottom of the incline.

6698. (*Sir William Lewis.*) You say in your Report, as Professor Dixon suggests: "My colleague, Mr. W. "N. Atkinson, however, having examined under the "microscope some of the dust which he collected from "the side of the road 100 yards inside the horse gug, "informs me that it clearly showed that some of it "had been in a state of incandescence, and the same "would appear to have been the case all the way, "from that point in to the shot." Do you wish to qualify the statement in your Report?—Mr. Atkinson has read this Report and has not corrected it, so I presume that it must be correct, that I am right, and that this other specimen refers to something else.

6699. If that is correct the flame must have passed over those 30 or 40 yards of damp place which you paced?—Yes; in my opinion it did do so, but I have not got any data which actually enabled me to specifically say so.

6700. Proof which you yourself saw?—Which I myself saw. The film of coal dust led me to believe that it was so.

6701. In your experience of explosions in coal mines would you say that there was less evidence here of flame, less charring and less dust, than in those you have previously examined?—Generally speaking it is so. As regards the amount of charring I may say that at the Malago explosion, except in the vicinity of the seat of the explosion, there was not much charred dust on the timbers.

6702. You said, I think in answering a question, that the stoppings after the explosion were put in near the bottom of the incline?—On the outer side.

6703. Mr. Garthwaite said they were close to Robert's Dipple?—Yes; I described it merely roughly because it is not actually marked on the plan that I have got where the roads were.

6704. You have had considerable experience, I suppose, in testing for fire-damp in mines?—I have.

6705. What per-centage of fire-damp do you feel sure that you could detect in the ordinary way?—I am afraid I could not answer that of my own knowledge. I have never chemically examined the fire-damp. I have seen a cap of about an eighth of an inch, but I personally cannot say the actual per-centage.

6706. When you examined the mine after the stoppings were opened, did you use Mr. Stokes' lamp?—No.

6707. An ordinary Davy lamp?—Ordinary lamps; they were extinguished immediately when put in the current.

6708. You examined not only the road between the stopping and the face but the face itself?—Yes.

6709. Then in your judgment, if there had been any gas in this pit at all, where would it have been found after the explosion; would you expect any to have been found?—I should have expected it to have been found in the return, and I should have expected it to have been found beyond the shot near the face.

6710. Would you expect any to be found in the cavities of the roof?—Yes, in any of the high places; I should have thought that some would very likely have been on the top of some of those falls on the road in.

6711. Some of which were a very considerable height above the road?—Yes, I should think some of them were 10 or 12 feet above the road.

6712. Possibly you would expect any gas, if such existed, to be found at the entrance of this old road which is near the shot?—In any of the cracks of the roof I should have expected it.

6613. Which way would air have been drawn out from that old road if any air was drawn out at all or into it by the ventilation of the mine?—It would be drawn away from it.

6714. (*Sir William Lewis.*) Into the current out of the goaf into the main ways?—Yes.

6715. (*Professor Dixon.*) So that entering that old road if any gas was in that old goaf you would expect to find it just inside the entrance?—If there was any gas there I should have thought that that would have been the place; it was a dead road or comparatively so.

6716. It only goes about 10 yards in; you will see it upon this plan?—It was stowed up to within 2 or 3 yards of the road. *This* is the working.

6717. You may remember that we could not get into it?—It had been stowed up.

6718. Do you remember the circumstances of the Malago explosion?—Yes.

6719. What was your opinion at the time with regard to that explosion—I mean with regard to the dust carrying on the explosion up the incline?—I considered the dust had carried it forward a good deal; it was a fire-damp explosion, but the extension of it was due more or less to dust. That was my opinion at the time.

6720. Would you be at all inclined to modify that opinion now and consider that the dust played a still more important part in that explosion?—I think it played a very large part in it. In that case I may say that the force and the flame travelled with the air current in the return; it did so in the case referred to as having occurred at the Ludlow's Pit of the Radstock Colliery.

6721. It did not follow the air current through the levels on each side of the incline; it only went a short way, if I remember rightly, into the working?—It went in one of the levels, I think a couple of hundred yards, but we had not got very distinct proof of it. I think there was a brattice sheet, or a door, that showed it on one of the intermediate levels, but as a rule it did not go very far into the workings.

6722. So that it did not follow the air current all the way but it went straight up the incline?—The incline was the main return current.

The witness withdrew.

Prof. H. Dixon.

16 Mar. 1891.

Professor Harold Dixon (a member of the Commission) examined.

6723. (*Chairman.*) I think that you have made a great number of experiments in testing small percentages of fire-damp both in the laboratory and also in some of the pits?—I have made a good many experiments, I will not say a great number, but a good many.

6724. In these experiments what apparatus have you used?—I have used the ordinary Davy lamp, and I have used one or two of the more modern lamps which are at present used in the Lancashire and Yorkshire district; I have especially used Professor Clowes' hydrogen lamp.

6725. By means of that lamp what is the smallest per-centage of fire-damp that you have been able to detect?—I have been quite sure of one quarter per cent.

6726. Of course one quarter per cent. is a quantity that is not explosive?—Not at all, and it is not indicated by an ordinary lamp.

6727. Did you test the air at the Camerton Colliery after the explosion?—Yes, I tested the air at two places in the returns, and I tested it at several places in the intake, especially in the cavities in the roof; wherever we found a considerable fall of roof I climbed up as high as I could and tested close to the roof. I also tested at the entrance to this old road coming from the goaf which is close to the spot where the shot was fired.

6728. Did you test the working face?—I also tested at two places in the working faces.

6729. All these testings were made with Clowes' hydrogen lamp?—Yes, all.

6730. What was the result?—I could detect no gas whatsoever.

6731. In your opinion if there had been even so little as a quarter per cent. you would have detected it?—I am quite sure of that.

6732. Then in the course of this inquiry you have visited several of the scenes of explosions which have taken place?—Yes.

6733. Would you name which are the cases that you have investigated?—The Apedale Colliery explosion, the Malago explosion, the explosion at Ludlow's pit in the Radstock district (that was a blown-out shot which fired dust and burnt a man, but no loss of life ensued), the Park Slip Colliery explosion, and the Camerton Colliery explosion.

6734. Have you prepared any report on the result of these investigations?—I have written a short report on what I have myself seen, and the conclusions that I have drawn.

6735. Will you kindly put it in?—I will.

6736. (*Sir William Lewis.*) May I ask what modern safety lamps you refer to as having applied as a test for gas?—Yes, I used Mr. Stokes' alcohol lamp, the Pieler lamp, the Marsaut lamp, and one or two others.

6737. I am asking you now because there is a lamp that is very generally used in South Wales. I do not know whether you have tried it; it is called the Evan-Thomas lamp; it was one that gave very satisfactory results in the experiments of the Mines Commission?—I have tried it and also the Thorneburry and the Hepplethwaite-Gray.

6738. With respect to the test that you made of what you found in the cavities, did you find any difference at all in the cavities there?—I found no difference.

Conclusion of the Evidence.

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APPENDIX XIII.

ABSTRACT OF PART OF THE FINAL REPORT OF THE AUSTRIAN FIRE-DAMP COMMISSION.

Part III.

Coal Dust.

The experiments made by the Austrian Commission confirm those made at Neunkirchen and Zwickau with regard to the danger of coal dust, but also show that the dangers are far greater than have hitherto been admitted.

First of all, the Commission tested the different kinds of coal dust, so as to classify them according to their sensitiveness to ignition and their danger.

As they considered that black powder and similar explosives are dangerous in fiery mines, and that their use should be entirely prohibited, they confined their experiments to high explosives, especially dynamite No. 1.

The experiments were made in a level like the one at Neunkirchen. Each kind of dust that was used was also tested in order to determine the following facts concerning it:—

1. Per-centage of volatile matter.
2. Hygroscopic moisture.
3. Per-centage of ash.
4. Quantity of marsh-gas in 100 grammes of dust.
5. Quantity of gas given out by 100 gr. of dust at 100° C.
6. Composition of gas given out by 100 gr. of dust at 100° C.

Instead of imitating blown-out shots, the experiments were mostly made with cartridges of dynamite lying loose, or with a slight covering of coal dust.

The coal dust experiments were almost exclusively made without any admixture of gas. In all 353 experiments were made with 345 kinds of dust. These experiments showed that many notoriously dangerous dusts were less inflammable than other less dangerous dusts. Coal dusts were therefore classified into *sensitive* and *dangerous* kinds.

To judge of their sensitiveness, coal dusts were all tested with the same charge of dynamite, viz., 100 grammes. The experiments showed that *without any admixture of fire-damp*, nearly all kinds of coal dust were ignited by a cartridge of 100 grammes of dynamite lying loose.

To ascertain the relative dangers of the different kinds of coal dust, the lengths of flame were noted, and such as gave a flame 15 m. (49 ft.) and over, in length, were omitted as specially dangerous.

The experiments made with a small admixture of fire-damp proved that such an admixture notably increased the danger and sensitiveness of the coal dust.

The degree of inflammability can scarcely be deduced from the chemical composition.

The texture of the coal is important. Hard compact coal will give less dust than crumbling friable coal. The fineness of the coal dust depends upon its texture.

The sensitiveness of a coal dust and, as a rule, its danger increase with its fineness.

The sensitiveness of a coal dust and, as a rule, its danger increase with its dryness.

The danger of a coal dust appears to depend more upon its physical qualities than upon its chemical composition.

A blown-out shot with coal dust as tamping, or a charge of dynamite lying free will ignite every kind of coal dust. Most kinds of coal dust were ignited with a charge of 100 gr. (3½ oz.), and all without exception were ignited with a charge of 300 gr. (10½ oz.).

A coal dust which otherwise is not dangerous and takes fire with difficulty may give rise to a disastrous explosion if there is a little fire-damp present.

Means of preventing the Danger of Coal Dust.

1. *Watering.*—This is undoubtedly useful, but it cannot guarantee thorough safety unless all the roadways and working places are watered and all parts of them, including the roofs and sides. Such a watering could not be effectively carried out without very great difficulties, indeed the difficulties might be insurmountable in some cases.

2. *Removal.*—Sweeping out the dust where shots are fired is troublesome and will rarely be properly carried out.

3. There should be no unnecessary exposure of the coal by roadways or workings, because all these help to dry up the coal and favour the production of dust.

An excessive ventilating current in dusty mines must be injurious on account of its drying the dust and the coal.

4. Blasting is the greatest source of danger in dusty mines. The water cartridge is useful, but its efficiency is dependent upon the conscientiousness of the workmen. Galloway's moss tamping is more practical.

These objections have led to the introduction of an explosive having salts containing water (carbonate of soda, Epsom salts) intimately mixed with it, and called "Wetterdynamite." The Wetterdynamite, used at the Wilhelm Pit, Ostrau, was a mixture of 52 parts of nitroglycerine, 14 parts of infusorial earth, and 34 parts of crystallized carbonate of soda. The experiments at Ostrau have shown that black powder and its congeners are highly dangerous for fiery mines in which there is coal dust. Even in water cartridges these explosives do not give sufficient safety. Neither do dynamite and its congeners, such as blasting-gelatine and gelatine-dynamite. A sufficiently large charge lying loose will ignite most kinds of coal dust. These high explosives must therefore be called dangerous. However, if the charge is covered with a sufficiently thick layer of some uninflammable substance, it will not ignite explosive mixtures of fire-damp and coal dust. Therefore, by the addition of a comparatively insignificant means of protection, these high explosives can be made safe. This is not the case, except as regards Wetterdynamite, with the less powerful explosives such as gunpowder.

The Ostrau experiments show that the Soda-wetterdynamite, of the composition given above, is superior to all other kinds of Wetterdynamite tried. Loose charges of Soda-wetterdynamite weighing 500 gr. (1 lb.) did not ignite the most dangerous coal dust in the absence of fire-damp.

Charges of 150 gr. (5¼ oz.) would not ignite an explosive atmosphere with 9 per cent. of fire-damp, with or without coal dust. A charge of 200 gr. (7 oz.) would always ignite an explosive atmosphere with 9 per cent. of fire-damp, but not one with 7 per cent. The latest experiments at Neunkirchen show even a higher degree of safety.

Soda-wetterdynamite can therefore be regarded as an explosive offering great safety in fiery mines, even if there be coal dust present.

At Rossitz loose charges of Soda-wetterdynamite weighing 150 gr. (5¼ oz.) gave explosions with a 6 per cent. mixture of fire-damp and air, without any coal dust; but where no gas was present charges of 300 gr. (10½ oz.) were fired without any explosion. The Rossitz results are less favourable than those at Ostrau and Neunkirchen; this may be explained by the experimental explosion chamber at Rossitz being very much smaller than the one at Ostrau.

Although the discovery of Wetterdynamite has rendered special safety cartridges of less importance than they were before, new proposals have been made in this direction, and they have been put to the test by the Ostrau local committee.

One of the simplest and safest is the canvas-sand cartridge. The dynamite cartridge is enveloped in a case of coarse canvas which has a layer of sand about 1 mm. (one twenty-fifth of an inch) thick glued over it. It is dipped in water before being used. Experiments made in an atmosphere containing 9 per cent. of fire-damp and coal dust with cartridges lying loose almost always gave satisfactory results, and showed that with a small amount of protection high explosives can be made comparatively safe in fiery mines.

A reliable Wetterdynamite seems the safest means of retaining blasting in dusty mines.

5. A safe explosive becomes unsafe if a dangerous mode of firing is adopted.

In the Austrian fiery mines three methods of firing are in use, Bickford's fuse, electricity, and Lauer's friction fuse.

Bickford's fuse cannot be regarded as safe, for it emits sparks. Electric firing is safe enough if it is properly looked after; if not properly attended to, sparks from the machine or badly isolated wires may cause explosions. The safest mode of firing is by Lauer's friction fuse.

In spite of all precautions, blasting in mines with fire-damp and coal dust present is always critical and dangerous. In special dangerous mines it appears advisable that under certain circumstances blasting should be given up altogether.

Part VII.

Summary and Proposals.

The Commission propose that fiery mines should be classified according to the proportion of fire-damp and carbon dioxide in the return air, assuming a similar amount of ventilation for all mines of 2 cm. per man and per minute (70 cubic feet), or 1½ cm. (53 cubic feet) per minute and per ton raised in 24 hours.

They propose three classes of mines :—

1. Fiery mines with little fire-damp, those in which the returns contain less than 1 per cent. of gas (CH_4 + CO_2).

2. Fiery mines with a moderate amount of fire-damp, those in which the return air contains between 1 and 2 per cent. of gas.

3. Fiery mines with much fire-damp, in which the return air contains more than 2 per cent. of gas.

Mines should have two shafts or outlets. If the two outlets are in the same building, they must be separated by a fireproof partition for fear of the two shafts being endangered by a fire.

The free and clear section of ventilating shafts and compartments shall be large enough to allow the requisite amount of air to pass through with a moderate velocity, not exceeding 6 m. (20 feet).

Then follow sundry regulations for securing adequate ventilation in all sorts of working places.

Ventilation.—Class I. Little fire-damp, 2 cm. (70 c. ft.) per man per minute, reckoned on the greatest number of persons in the mine at one time.

Class II. Moderate amount of fire-damp, 3 cm. (105 c. ft.) per man per minute.

Class III. Much fire-damp; at least 4 cm. (141 c. ft.) per man and per minute.

Division of mine into parts, and not more than 100 persons to be in one part.

Downward ventilation to be allowed only in exceptional cases.

Numerous other regulations.

Lighting.—Safety lamps to be obligatory in all mines pronounced to be fiery mines.

Mixed lights to be allowed by special permission in mines under Class I., in which there is little fire-damp, where the gas comes off only in a few working places and sporadically.

It is not necessary to prescribe any special kind of safety lamp. But lamps other than the Mueseler, Wolf with two gauzes, and Marsaut should not be used without permission of the Government authorities.

Sundry other regulations about safety lamps.

Blasting.—This is one of the chief causes of accidents in mines containing fire-damp or coal dust.

Blasting may cause accidents in two ways :—

1. By the fuse. This source of danger may be got rid of by using Lauer's friction fuse.

2. By the explosive. This source of danger is specially present with black powder. With the high explosives like dynamite it is principally a blown-out shot that is dangerous.

Water cartridges and safety cartridges require much care, and it is not easy to ensure their being properly used.

The safety obtained with Soda-wetterdynamite is very great and almost absolute.

No doubt other equally safe explosives will be discovered.

The following rules as regards blasting should be enforced in all fiery mines :—

1. The use of black powder and its congeners should be prohibited except in mines with very little fire-damp.

2. In mines with a moderate or a large amount of fire-damp blasting with Bickford safety fuse and high explosives should be permitted only when no gas has been indicated by a sensitive and approved form of lamp (Pieler lamp). If there is a trace of gas, no shot must be fired except with the permission and in the presence of an official. If the per-centage of gas reaches as much as 1 to $1\frac{1}{2}$, the shot must be fired with the Lauer friction fuse or some other approved fuse.

If the per-centage of gas in the ventilating current is 2 to $2\frac{1}{2}$, then only duly tested explosives (Soda-wetterdynamite of the composition 52 per cent. nitroglycerine, 14 per cent. infusorial earth, 34 per cent. crystallized carbonate of soda) must be used. No other explosive to be used without the permission of the authorities.

If the per-centage of gas in the ventilating current is 3 to $3\frac{1}{2}$, then no blasting must be done.

Tamping with wet sand is recommended.

Coal Dust. — Wetterdynamite gives almost absolute safety in blasting in mines even with the most sensitive coal dust.

In fiery mines with much coal dust, the following rules should be observed :—

The workings should be divided into districts or parts with separate ventilation. All connecting roadways should be shut off securely and kept free from coal dust. These connecting roadways should in part be lined with brickwork or masonry, and any loose coal dust which might collect there should be rendered harmless by watering. The same precaution should be taken in all main roadways and haulage ways.

If much dust is found in working places, blasting with high explosives must only be allowed when the coal dust has been completely removed for a distance of 10 m. (32 ft.) from the shot, or has been thoroughly watered. If this cannot be done, blasting must be given up or a safety explosive, such as Soda-wetterdynamite, must be used.

If, in addition to coal dust, there is an emission of fire-damp sufficient to give $\frac{1}{2}$ to 1 per cent. in the ventilating current, the shot must be lit by the Lauer fuse or some similar fuse.

If there is as much as 2 to $2\frac{1}{2}$ of fire-damp in the ventilating current, then blasting must be given up altogether.

No blasting should be done except in the presence of an official.

The concluding proposed regulations relate mainly to the staff of officials.

C. Le Neve Foster.

Llandudno, 30th July 1891.

APPENDIX XIV.

Handed in by Mr. James Ashworth. (See *Minutes of Evidence, Question* 4625.)

Case A.—The atmosphere of the mine is supposed to consist of 1 volume of fire-damp, 14 volumes of air, $5\frac{1}{2}$ grains of aqueous vapour, 7·3 per cent. of coal dust by weight, and the resultant gases from 1 lb. of powder, composed of saltpetre 66, sulphur 10·5, charcoal 23·5.

Case B.—The atmosphere is as in Case A. with the substitution of 1 lb. of Karolyi's powder for No. II.

Karolyi exploded a charge of powder composed of saltpetre 73·78, sulphur 12·80, and carbon 13·39 in an iron cylinder of such strength that it would just burst when the powder was fired. This cylinder was enclosed in a hollow spherical bomb and the air exhausted before firing by an electric spark. The resultant gases and solids were as follows :—

—	Weight.		Volume.
Gas.			
Nitrogen	9·77	30·58	37·58
Carbonic acid	17·39		42·74
Carbonic oxide	2·64		10·19
Hydrogen	0·11		5·93
Sulphuretted hydrogen	0·27		0·86
Marsh gas	0·40		2·70
Solid.			
Ammonic sesquicarbonate	2·68	69·25	
Potassic sulphate	36·95		
„ carbonate	19·40		
„ hyposulphite	2·85		
„ sulphide	0·11		
Charcoal	2·57		
Sulphur	4·69		
Loss		0·17	
		100·00	100·00

The gas contained a sufficient quantity of carbonic oxide, hydrogen, and its compounds to take fire on the application of a lighted match.

Before Explosion.

			Case A.				Case B.				
—	—	Per Cent.	Volume, Litres.		Weight, Grammes.		Per Cent.	Volume, Litres.		Weight, Grammes.	
Fire-damp	CH_4	—	0·067× }		0·0452×	0·0452×	—	—	—	—	0·0452×
Air {	O	—	0·187× }	1·00×	0·2530× }	1·1384×	—	—	1·00×	—	—
	N	—	0·746× }		0·8854× }		—	—	—	—	1·1384×
Water	H_2O	—	—	—	0·0126×	0·0126×	—	—	—	—	0·0126×
	C	81	—	—	0·0691× }						
	H	5	—	—	0·0044× }						
Coal dust {	N	2	—	—	0·0015× }	0·0882×	—	—	—	—	0·0882×
	O	10	—	—	0·0088× }						
	Ash	2	—	—	0·0044× }						
		100									
	KNO_3	66·0	—	—	299·4 }		73·78 }				
Powder {	S	10·5	—	—	47·4 }	453·6	12·8 }	—	—	—	453·6
	C	23·5	—	—	106·8 }		13·39 }				

After Explosion.

			Case A.				Case B.				
—	—	Per Cent.	Volume, Litres.		Weight, Grammes.		Per Cent.	Volume, Litres.		Weight, Grammes.	
Water in air	—	—	—	—	0·0126× }						
Ditto from CH_4	—	—	—	—	0·1017× }	0·1539×	—	—	—	—	0·1539×
Ditto from H of coal dust	—	—	—	—	0·0396× }						
CO from CH_4	—	—	0·067× }	0·203×	0·0791× }	0·2403×	—	—	0·203×	—	0·2403×
CO from coal dust	—	—	0·136× }		0·1612× }						
CO from powder	—	—	210	210	249·1	249·1	—	10·1	10·1	12·0	12·0
N from air	—	—	0·746× }		0·8854×	—	—	—	0·747×	—	0·8869×
				0·747×	—	0·8869×	—	—	—	—	—
N from coal dust	—	—	0·001× }		0·0015×	—	—	—	--	—	—
N from powder	—	—	34·99	34·99	41·5	41·5	—	37·3	37·3	44·3	44·3
CO_2 from powder	—	—	—	—	—	—	—	42·3	42·3	78·9	78·9
Ash from coal	—	—	—	—	0·0044×	0·0044×	—	—	—	0·0044×	0·0044×
K_2S from powder	—	—	—	—	1·63	1·63	—	—	—	0·5	0·5
H_2S " "	—	—	—	—	—	—	—	0·8	0·8	1·2	1·2
H " "	—	—	—	—	—	—	—	5·9	5·9	0·5	0·5
O left in atmosphere	—	—	—	—	—	—	—	—	—	—	—
CH_4 from powder	—	—	—	—	—	—	—	2·6	2·6	1·8	1·8

After the Return of the Fire.

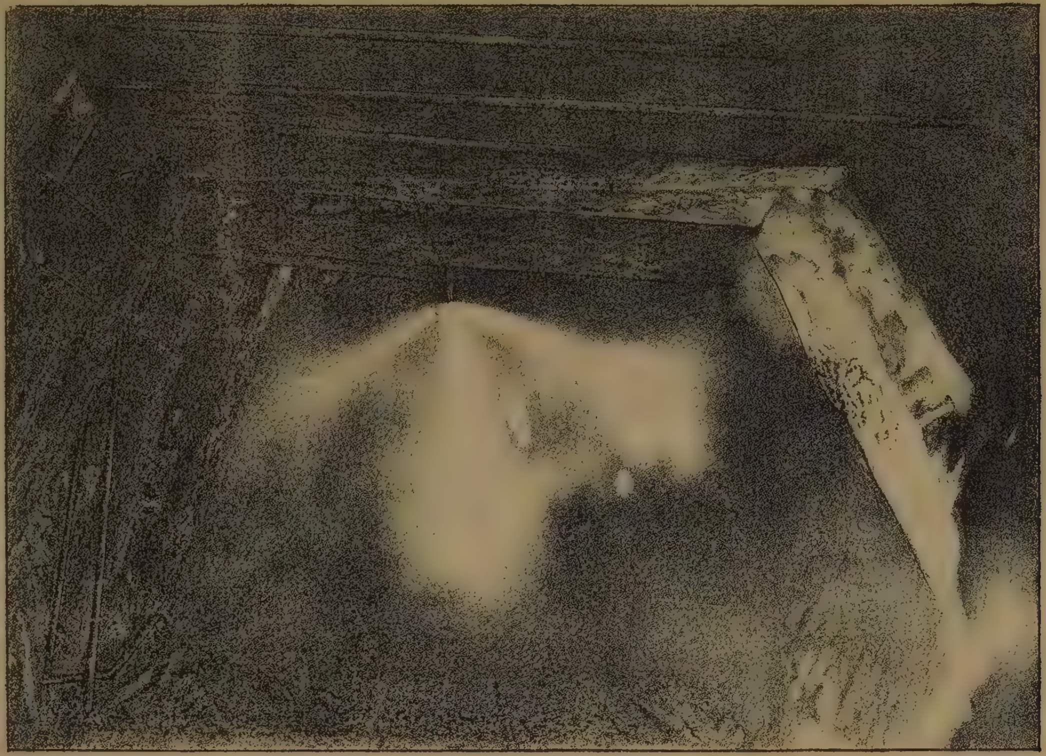
	Case A.				Case B.			
—	Volume, Litres.		Weight, Grammes.		Volume, Litres.		Weight, Grammes.	
CO_2 from above CO	0·203×	0·203×	0·3776×	0·3776×	0·203×	0·203×	0·3776×	0·3776×
CO_2 from powder	210	210	391·4	391·4	10·1 } 42·3 }	52·4	19·0 } 78·9 }	97·9
CO_2 from CH_4 of powder	—	—	—	—	2·6	2·6	4·9	4·9
Water from above	—	—	0·1539×	0·1539×	—	—	0·1539×	0·1539×
Ditto from H of powder	—	—	—	—	—	—	4·5 }	
Ditto from H_2S of powder	—	—	—	—	—	—	0·6 }	9·1
Ditto from CH_4 of powder	—	—	—	—	—	—	4·0 }	
SO_2 from H_2S of powder	—	—	—	—	—	—	2·2	2·2
Ash from coal	—	—	0·0044×	0·0044×	—	—	0·0044×	0·0044×
N from air	0·747×	0·747×	0·8869×	0·8869×	0·747×	0·747×	0·8869×	0·8869×
N from powder	34·99	34·99	41·5	41·5	37·3	37·3	44·3	44·3
Ammonic sesquicarbonate	—	—	—	—	—	—	12·1	12·1
K_2SO_4	—	—	—	—	—	—	167·4	167·4
K_2CO_3	—	—	—	—	—	—	88·0	88·0
$K_2S_2O_3$	—	—	—	—	—	—	12·9	12·9
K_2S	—	—	1·63	1·63	—	—	0·5	0·5
C	—	—	—	—	—	—	11·6	11·6
S	—	—	—	—	—	—	21·3	21·3
O taken from external air	0·101×	0·101×	—	—	0·101×	0·101×	—	—
O " " " for powder	105	105	—	--	18·1	18·1	—	—
Vacuum equals	(0·151 × − 139·99)				(0·151 × − 77·9)			

× = the volume of the atmosphere at 15° C. and 760 m.m. pressure.

Royal Commission on Explosions from Coal Dust in Mines.

Appendix XV. (*b.*)

To illustrate Mr H. W. Martin's Evidence. See Minutes of Evidence. – Question 5375.



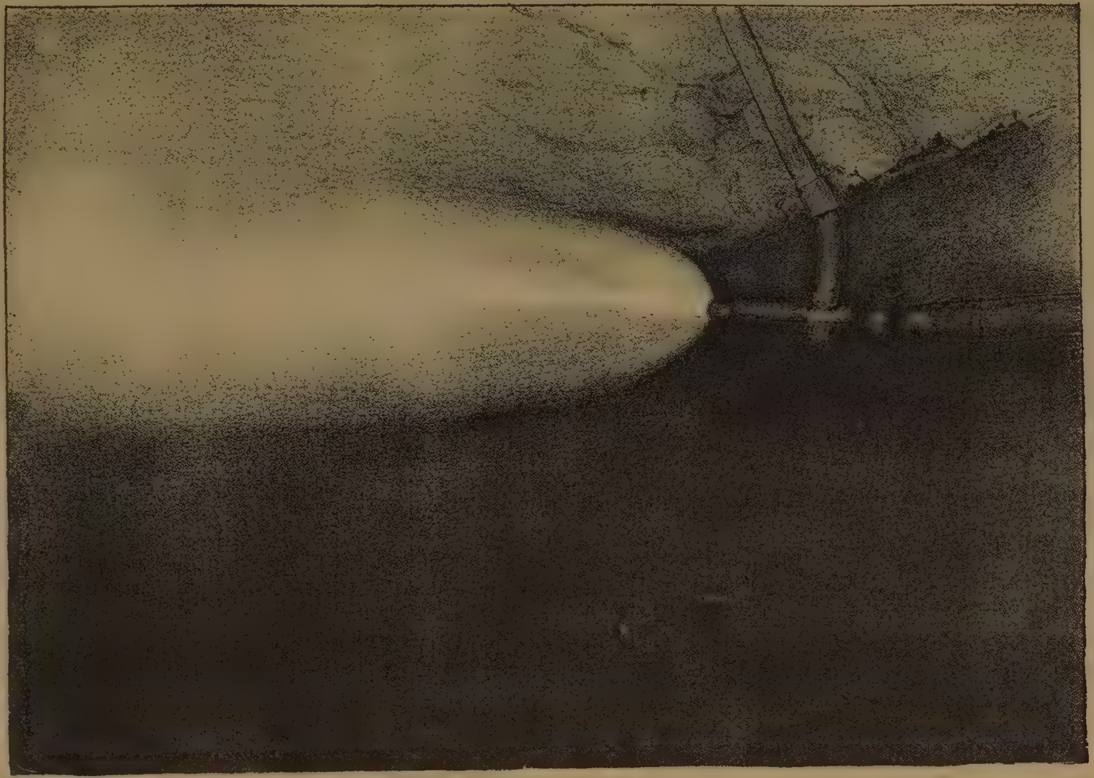
H. W. Martin

Judd & Co Ltd, Lith. 63, Carter Lane, Doctors' Commons. 3436. 4. 92

Royal Commission on Explosions from Coal Dust in Mines.

Appendix XV (c.)

To illustrate Mr. H. W. Martin's Evidence – See Minutes of Evidence – Question 5375.



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ROYAL COMMISSION ON EXPLOSIONS FROM COAL DUST IN MINES.

APPENDIX XV. (*d*)

To illustrate Mr. H. W. Martin's Evidence. — See Minutes of Evidence, Question 5375.

DOWLAIS COLLIERIES.

HYGROMETRICAL READINGS WITH MARTIN & TURNBULL'S PATENT COMPRESSED AIR & WATER SPRAY.

IN THE TUNNEL SOUTH PIT.

HYGROMETRICAL READINGS. IN MAIN "INTAKE"

	No. of Spray	Distance of Spray from Pit in Yards	Distance of Hygrm. from the Spray in Yards	Temperature of the Air in Fahr. degs. when Spray is Not Working: Dry Bulb	Not Working: Wet Bulb	Working: Dry Bulb	Working: Wet Bulb	Vol. of Air in Cubic ft. per Min.	Velo. of Air in ft. per Min.	Pres. of Comp. Air in lbs. per □"	Pres. of Water in lbs. per □"
Little Vein Drift	1	161						32,000	550	45	166
			35	54°	52°	51°	51°				
	2	206									
			66	54°	52°	51°	51°				
	3	264									171
			66	55°	52¾°	52°	52°				
	4	370									
			66	56°	54°	52½°	52½°				
	5	438									200
	6	560									
			66	56½	55	54	54				
	7	660									
	8	824									
			on Parting 20	57½°	55°	55°	55°				245
No. 3 West Level	9	922									
			40	58°	56°	55°	55°	8,000	230		
	10	1,015									
			44	59°	57°	56°	56°				
	11	1,037									
	12	1,068									
			44	65°	64°	64°	64°	11,000	340		
	13	1,129									
	14	1244									
			44	66°	64°	64°	64°				
	15	1281									
	16	1,325									
			44	67°	65°	64½°	64½°				
	17	1,372									
	18	1,444									
			44	67½°	65½°	65°	65°				
	19	1496									
	20	1,538									
			36	68°	66½°	66°	66°				
	21	1,584									
	22	1,631									
			30	68½°	66½°	66°	66°				
Coal face	23	1678									
		1738	60	69°	68°	67°	67°				

HYGROMETRICAL READINGS. IN MAIN "RETURN"

	No. of Spray	Distance of Spray from Pit in Yards	Distance of Hygrm. from the Spray in Yards	Temperature of the Air in Fahr. degs. when Spray is Not Working: Dry Bulb	Not Working: Wet Bulb	Working: Dry Bulb	Working: Wet Bulb	Vol. of Air in Cubic ft. per Min.	Velo. of Air in ft. per Min.	Pres. of Comp. Air in lbs. per □"	Pres. of Water in lbs. per □"
No. 1 East Level	24	244								45	120
			30	65°	64°	64°	64°				
	25	269									
			27	65°	64°	64°	64°				
No. 2 West Level	26	536									
			30	65°	64°	64°	64°	19,000	700		
No. 2 East Level	27	558									
			44	61°	58°	58°	58°				
	28	680									
			31	61½°	59°	59°	59°				
	29	748						13,000	600		
			41	64°	61½°	61½°	61½°				
	30	854									
			30	65°	63°	63°	63°				
	31	912									
			30	67°	65°	65°	65°				

HYGROMETRICAL READINGS WITH WATER SPRAY.

IN BEDLINOG, No. 2 PIT.

HYGROMETRICAL READINGS. IN MAIN "RETURN"

	No. of Spray	Distance of Spray from Pit in Yards	Distance of Hygrm. from the Spray in Yards	Temperature of the Air in Fahr. degs. when Spray is Not Working: Dry Bulb	Not Working: Wet Bulb	Working: Dry Bulb	Working: Wet Bulb	Vol. of Air in Cubic ft. per Min.	Velo. of Air in ft. per Min.	Pres. of Water in lbs. per □"
Main Level	1	122						84000	1.000	200
			16	67°	65°	65°	65°			
	2	174								
			16	68°	66°	66°	66°			
	3	231								
	4									
			17	68°	66°	66°	66°			
	4	273								
			24	68°	66°	66°	66°			
1st Incline	5	340								
			17	68°	66°	66°	66°			
	6	410								
			22	68°	66°	66°	66°			
	7	444								
			18	68°	66°	66°	66°			
	8	513								
			18	68°	67°	67°	67°	59500	850	185
2nd Incline	9	573								
			18	68°	67°	67°	67°			
	10	634								
			16	68°	67°	67°	67°			
	11	699								
			18	68°	67°	67°	67°			
	12	774								
			18	68½°	67°	67°	67°	50,000	1000	140
	13	823								
			18	68½°	67°	67°	67°			
3rd Incline	14	873								
			18	68½°	67°	67°	67°			
	15	911								
			14	69°	67°	67°	67°			
	16	976								
			16	69°	67°	67°	67°			
	17	1,053								
		1,069	16	69°	67°	67°	67°	29069	470	115

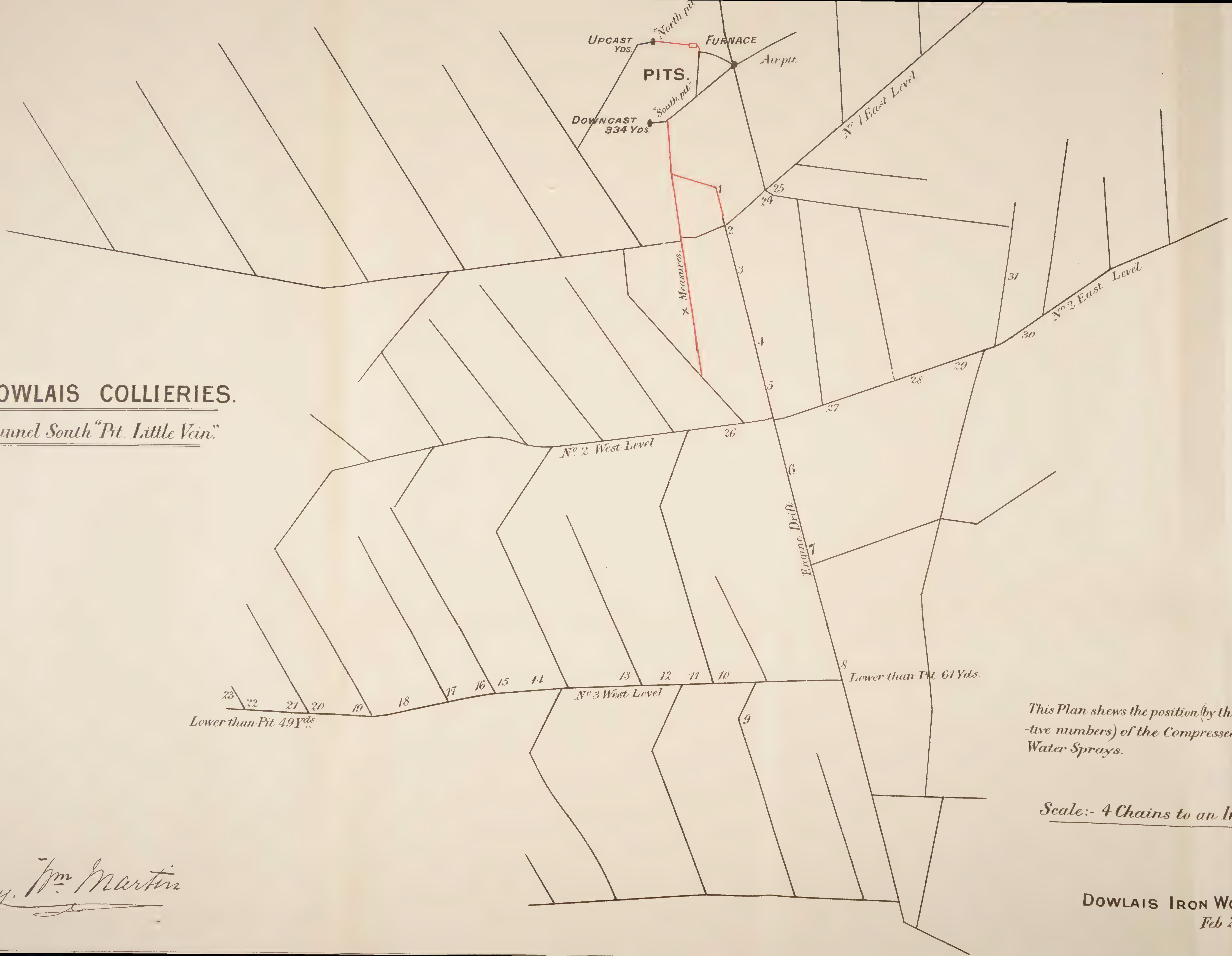
Henry. Wm. Martin

DOWLAIS IRON WORKS.

Feby. 29th 1892.

DOWLAIS COLLIERIES.

Tunnel South "Pit. Little Vein."



This Plan shews the position (by the consecutive numbers) of the Compressed-Air & Water Sprays.

Scale:- 4 Chains to an Inch.

Henry. Wm. Martin

DOWLAIS IRON WORKS.
Feb 29th 1892.

ROYAL COMMISSION ON EXPLOSIONS FROM COAL DUST IN MINES.

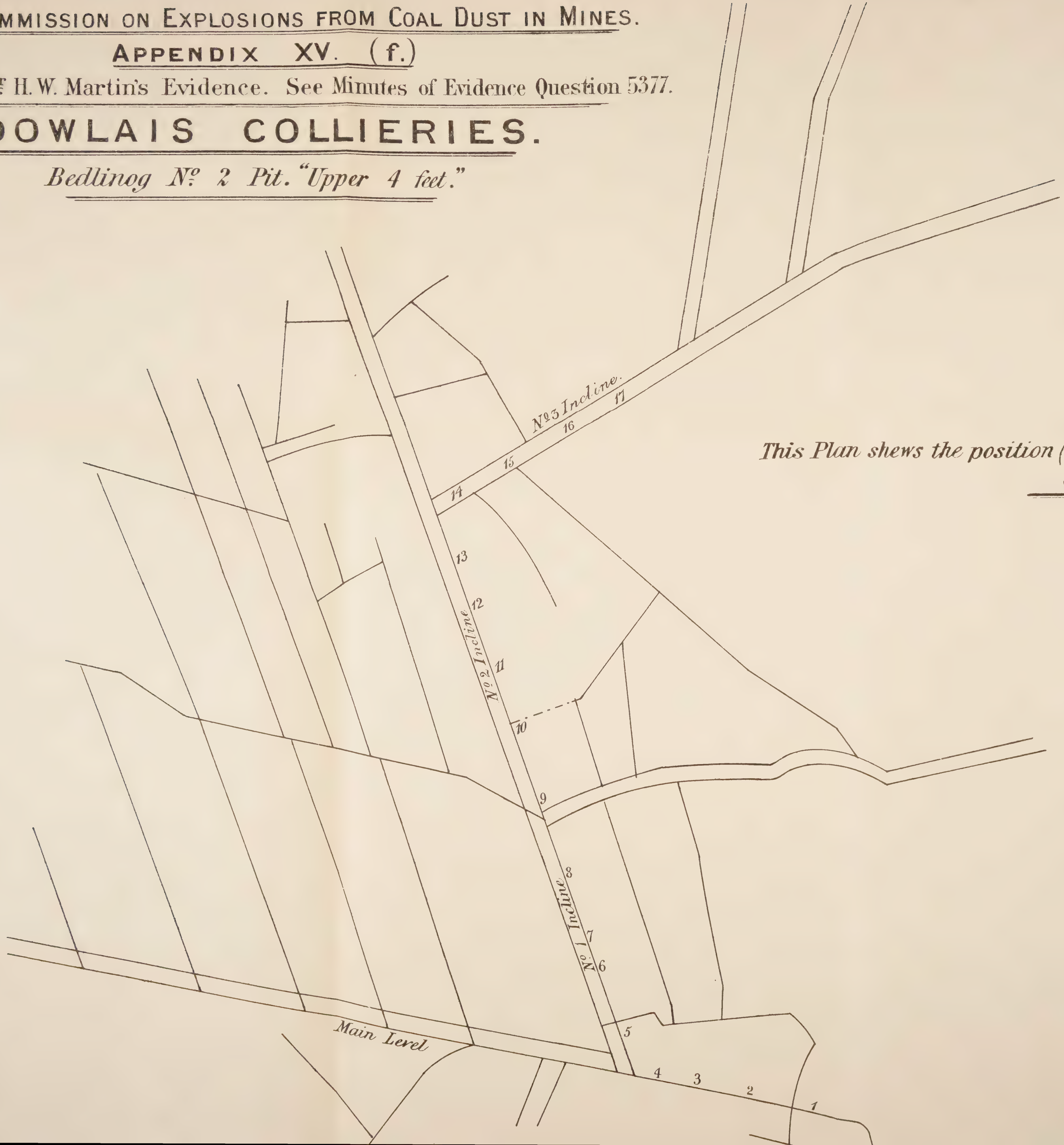
APPENDIX XV. (f.)

To illustrate Mr. H. W. Martin's Evidence. See Minutes of Evidence Question 5377.

DOWLAIS COLLIERIES.

Bedlinog No. 2 Pit. "Upper 4 feet."

This Plan shews the position (by the consecutive numbers) of the Water Sprays.



ROYAL COMMISSION ON EXPLOSIONS FROM COAL DUST IN MINES.

APPENDIX XVI *a*.

(To illustrate Mr. J. Mc. Murtrie's Evidence. See Minutes of Evidence, Question 6105.)

PLAN No. 1.

PLAN
— OF —
LOWER SERIES
LUDLOWS PIT.
SHOWING POSITION OF BLOWNOUT SHOT.
NOVEMBER 24TH 1891.

Judd & Co Ltd, Lith. 63, Carter Lane, 3435. 7. 93

ROYAL COMMISSION ON EXPLOSIONS FROM COAL DUST IN MINES.

PLAN Nº 2.

APPENDIX XVI *b*.

(To illustrate Mr J. Mc Murtrie's Evidence. See Minutes of Evidence, Question 6105.)

PLAN

ENLARGED

TO

1/16th of an Inch to the Foot.

LUDLOWS PIT.

RADSTOCK.

SECTION OF SEAM

SHOWING THE BOREHOLE.

Scale 1/2 inch to the Foot

Judd & Co Ltd, Lith. 63 Carter Lane 3436

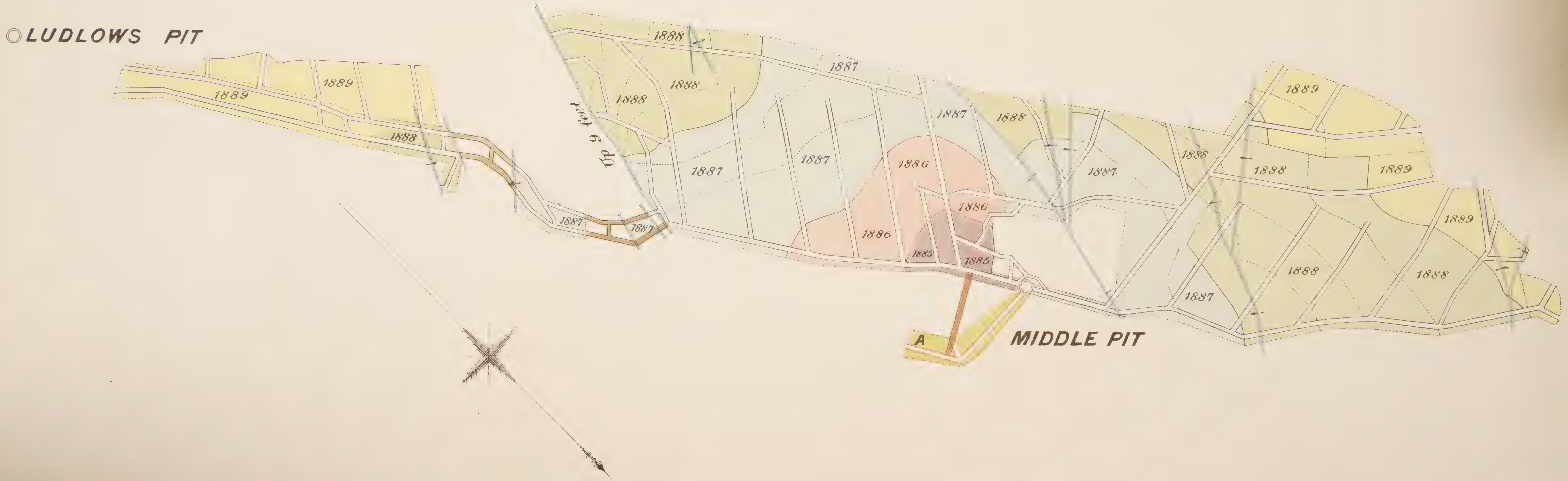
ROYAL COMMISSION ON EXPLOSIONS FROM COAL DUST IN MINES.

PLAN Nº 3.

APPENDIX XVI C.

(To illustrate Mr. J. Mc. Murtrie's Evidence. See Minutes of Evidence, Question 6081)

PLAN
— OF —
LOWER SERIES
MIDDLE PIT.
SHOWING POSITION OF BLOWNOUT SHOT.
JUNE 1889.



APPENDIX XVII.

Newcastle, Staffordshire,
April 9, 1892.

Sir,

We have the honour again to address you with reference to the tabular list of explosions published as Appendix IV. to the First Report of the Royal Commission on Explosions from coal dust in mines.

In this table the explosions occurring during the 39 years, 1851–89, are classified as follows:—A. Explosions in which, so far as there is evidence, coal dust probably played no part; B. Explosions in which coal dust probably played a part (insufficient evidence); C. Explosions in which coal dust probably played the principal part.

The table was handed in by Mr. J. B. Atkinson, when he gave evidence before the Commissioners. (Q. 709), together with a chronological list of the explosions and an abstract of the official reports on the explosions.

These abstracts were prepared at the request of Mr. Lushington, Under Secretary of State for the Home Department, as explained by him in his evidence (Q. 107 and 108). The table was merely an endeavour to summarise the conclusions which we thought might be drawn from the abstracts, which were relied on to show the reasons for the classification adopted, and the table was not intended for publication separately.

The abstracts were considered too voluminous for publication, and the table has been issued alone.

We submitted, for your consideration, in a letter dated the 14th ultimo, that it might be desirable to publish some of the abstracts in order to show the kind of data on which the table was based, and we received in reply a letter from Mr. Wilson, Secretary to the Commission, saying that the Commission "came to the "decision that it was not necessary to publish the "abstracts. In the first place they are very bulky, "and would add unduly to the size of the Report. In "the second place they are *ex parte* statements, being of "course compiled by yourselves, and would justify "applications for rebutting evidence to be taken in "regard to each of the explosions named. But if you "think that any injustice is done to you by the "publication of your tables without the abstracts, the "Commission would be happy to insert a letter ad-"dressed to them explaining the nature of the corro-"borative documents which are omitted."

We do not think that any injustice has been done to ourselves in the matter, but what we fear is that the omission of the abstracts explaining the grounds on which the table is based will deprive the table of its proper weight, indeed of all weight whatever. For it might be supposed that the results shown therein had been arrived at simply by assuming the question at issue, and attributing chiefly to coal dust nearly all the great explosions. Whereas the contrary is the fact, each case was separately studied and its place in the table fixed as the result of careful consideration of the circumstances.

The abstracts which we prepared, scrupulously distinguish any inference of our own from the reported facts of the case. In the main they consist of some or all of the following particulars, as specified in the official reports of those who made inquiry immediately after the explosion.

A brief description of the colliery, such as depth of shafts, name of seam, area of workings, mode of working, method of ventilation, and system of haulage. Evidence as to the presence of fire-damp and coal dust. System of lighting and use of explosives. Where possible, the course of the explosion and its extent is stated; the part of the mine traversed, as working faces, intake air-ways or return air-ways, and whether the explosion reached the shafts. Evidence as to previous alarm of the workmen is noticed. The supposed point of origin and the cause of the explosion (as stated in the official reports) is given, and any other point bearing on the question of fire-damp or coal dust is noticed.

We have the honour to be, sir,
Your obedient servants,
W. N. Atkinson.
J. B. Atkinson.

The Right Hon. J. Chamberlain, M.P.,
Chairman of the Royal Commission on
Explosions from Coal Dust in Mines.

APPENDIX XVIII.

Sir, Rainhill, Prescot, 23rd January, 1893.

I had the honour to submit to you in October, 1890, the result of some experiments, carried out on a large scale, to test to what extent colliery explosions may be due to blasting with gunpowder, in colliery workings which are dry and dusty, *and in the entire absence of fire-damp*.

At that time, although the experiments were perfectly conclusive to myself and the several gentlemen who witnessed them, there were certain aspects of the inquiry to which others took exception. The nature of those objections may be gathered from the evidence given by different witnesses before the "Coal Dust Commission," but this evidence was very scantily supported by any actual knowledge or facts, and was in many cases mere guess-work.

I have now the honour to report the result of further experiments carried out on three separate days under much the same conditions as the original experiments, but directed specially to the points upon which doubt still seemed to exist, and I think the result cannot escape being accepted as conclusive—*that dry coal dust, under conditions frequently present in coal mines, and in the entire absence of firedamp, may be inflamed by a blowing-out gunpowder shot and cause a disastrous colliery explosion.*

This series of experiments was made in the same pit shaft as on several previous occasions. It is 50 yards deep. Seven feet diameter, with struts of timber fixed every 6 or 7 feet at the sides of the shaft, from top to bottom, to represent bars and timbering underground, and to afford a lodgment for dust. The shots of gunpowder were fired from a cannon 3 feet long with a bore 2 inches in diameter and fixed at the bottom of the pit; the shots were fired by electricity. The pit shaft was very wet, and the struts of timber had to be scraped partly dry to enable the experiments to be carried out.

Experiments of the 11th June, 1892.

Weather, wet and damp. Temperature on the surface, dry bulb 53½°, wet bulb 53°. Temperature at the bottom of the shaft, dry bulb 57°, wet bulb 56°.

Present: Mr. W. N. Atkinson, Her Majesty's Inspector; Mr. Southworth, Mr. Bigg-Wither, Mr. Aspinwall, Mr. Lea, Mr. Wall, and several miners.

No. of Experiment.	Weight of Gunpowder.	Quantity of Dust.	Description of Dust.	Result and Remarks.
1	1 lb.	None	—	No unusual violence or flame. These three shots were fired simply to show the amount of disturbance in the absence of dust.
2	1½ lb.	None	—	
3	1½ lb.	None	—	
4	1½ lb.	2 cwts. 72 lbs.	White Moss screens.	A quick violent explosion, and flame projected high into the air at mouth of pit, causing great damage to staging. Half the dust was put in to sop up the wet in the shaft and allowed to go to rest, then the other half put in and the shot fired a minute later with dust in suspension.
5	1½ lb.	1 cwt.	Hindley Green return air-ways.	No explosion of dust. The cannon was fired 1½ minute after the dust was put down, with dust in suspension.
5*a*	1½ lb.	No fresh dust put in.	—	No explosion of dust. The dust was entirely at rest, and air in shaft clear. The cannon was fired one hour after No. 5 experiment.
6	1¼ lb.	1 cwt. 22 lbs.	Hindley Green screens.	Violent explosion, and flame projected at mouth of pit. The cannon was fired 1½ minute after putting dust down, and was still in suspension.
7	1¼ lb.	1 cwt. 12 lbs.	Hindley Green screens.	Dust apparently caught fire and went out. The cannon was fired four minutes after putting the dust down, very little in suspension.
8	1¼ lb.	1 cwt. 20 lbs.	White Moss screens.	No explosion of dust. The cannon was fired 2½ minutes after putting the dust down, and some still in suspension.

The results of this day's experiments were similar to those of the original series, but it must be noted as important that No. 4 explosion of dust was produced with that from White Moss Colliery, Arley seam, whilst in the original series Hindley Green dust played the most conspicuous part.

Experiments on the 6th December, 1892.

Weather, sleet, rain, and wind. Temperature on surface, dry bulb 42½°, wet bulb 40°. Pit shaft very wet, owing to melting snow, and had to scrape the timbers in shaft partly dry before commencing experiments.

Note.—A small fan, worked by hand, had now been erected, forcing fresh air from the surface down 10-inch pipes to the bottom of the shaft, and returning upwards in the shaft. *The additional ventilation thus secured had a remarkable effect on the later experiments.*

Present: Mr. Wardell, Her Majesty's Inspector; Professor Dixon, Mr. Kellett, Mr. Burrows, Mr. Bigg-Wither, Mr. Orsman, Mr. Mathews, Her Majesty's Inspector; Mr. Higson, Mr. House, Mr. Lea, Rev. Mr. Wickham.

No. of Experiment.	Weight of Gunpowder.	Quantity of Dust.	Description of Dust.	Result and Remarks.
1	1½ lb.	None	—	No unusual violence or flame. These two shots were fired simply to show the amount of disturbance in the absence of dust.
2	lbs.	None	—	
3	1½ lb.	4 cwt.	Hindley Green underground roads.	Miss-fire.
3*a*	1½ lb.	1 cwt.	Hindley Green underground roads.	A violent explosion, with flame projected out of the mouth of the pit. The cannon was fired 1½ minute after the last cwt. of dust was put down, and there was still some in suspension.
4	1½ lb. 1½ lb.	1 cwt. 50 lbs.	Hindley Green N. E. road underground and White Moss mixed.	A violent explosion, followed by volumes of flame rushing from the pit mouth. Used two firing cables, one with a bottle attached containing 1½ lb. of gunpowder, and the other attached to the cannon. The bottle was placed on the pit bottom, and the cannon suspended five yards above it. *All the dust was allowed to settle*, the air in the pit being clear at the end of 15 minutes. Then the bottle was exploded, causing little or no disturbance in the pit; two minutes later the cannon was fired, with the result as above. This experiment was intended to represent the firing of two successive shots underground, and any dust in suspension at the instant the cannon was fired must have been raised by exploding the bottle; the cannon being suspended five yards up the shaft, was clear of any large accumulation of dust about the pit bottom.

The result of this day's experiments proved that a very small quantity of dust in suspension in the air would, along with that at rest on the timbers, be sufficient to bring about the conditions under which a colliery explosion might happen through the firing of a gunpowder shot.

Experiments on the 17th January, 1893.

Weather, damp and thawing, improved as the day advanced. Temperature, dry bulb, 42°, wet bulb 40°. The shaft very wet, and the timbers had to be scraped partly dry before commencing experiments. *Small fan at work.*

Present: Mr. Kellett, Mr. N. R. Griffith, Mr. Boole, Mr. Grundy, Her Majesty's Inspector; Mr. Mathews, Her Majesty's Inspector; Mr. Bigg-Wither, Mr. Orsman Mr. Lea, Mr. Clark, Mr. Jackson, and others.

No. of Experiment.	Weight of Gunpowder.	Quantity of Dust.	Description of Dust.	Result and Remarks.
1	1½ lb.	None	—	No unusual violence or flame. These three shots were fired simply to show the amount of disturbance in the absence of dust.
2	1½ lb.	None	—	
3	2 lbs.	None	—	
4	1½ lb.	4 cwt.	Park Lane and White Moss mixed screens.	A violent explosion, and flame projected high into the air from the pit mouth. Two cwt. of this dust was put in to sop up the water in the shaft, and allowed to go to rest; then the remaining dust was put in, *also allowed to go to rest*. There was no dust in suspension at the end of 15 minutes, when the cannon was fired. *Note.*—This is the most remarkable experiment yet recorded, as there was actually no dust in suspension when the shot was fired, the whole of the mischief being due to the dust lodged on the timbers being disturbed by the shot.
5	1½ lb.	No fresh dust put down.	Same as in No. 4 experiment.	A violent explosion, and flame projected the same as in No. 4. This explosion was more severe than No. 4. There was no dust whatever in suspension, the mischief being entirely due to the unburnt dust of No. 4 experiment, which had again lodged on the timbers.
6	Roburite, 6 oz.	2 cwt.	White Moss screens	No explosion of dust or flame. Roburite. The roburite was fired one minute after putting the dust down, and which was still in suspension.
7	Roburite, 8 oz.	No fresh dust put down.	—	No explosion of dust or flame. Roburite. The roburite was fired 15 minutes after the dust of No. 6 experiment was put down. There was no dust in suspension.
8	Gunpowder, 1½ lb.	No fresh dust put down.	—	Violent explosion, with flame rushing from the mouth of the pit. The shot was fired 30 minutes after putting in the dust of No. 6 experiment, and there was no dust in suspension, the mischief being entirely due to the dust lodged on the timbers, which the shot disturbed and exploded. *Note.*—It must be noted that a gunpowder shot at once exploded the dust, after two roburite shots had been tried without success. The roburite shots were fired from iron tubes 2′ 6″ long, lightly tamped with coal dust. The tube was burst in each experiment. The cannon would not bear the shock of this explosive.

The result of this last day's experiments proved more remarkable and conclusive than on any previous occasion. In three successive experiments the firing of a charge of 1½ lb. of gunpowder, aided by dust, lodged on the timbers in the shaft, and in the absence of any dust in suspension, caused what might fairly be termed *violent colliery explosions*.

The decisive character of these latter experiments was no doubt due to the increased ventilation in the shaft through the operation of the small fan; in other words, the brisker the ventilation of a mine, the greater the danger from coal dust. This fact probably explains some of the explosions in the north of England, where the evidence pointed to their having originated in the main intake air-roads.

It is also, I think, quite clear that the explosive character of coal dust depends more upon its mechanical condition as to dryness and fineness than upon its chemical composition.

The various dusts used in the experiments were not subjected to any artificial treatment whatever, but were used just as collected; indeed, their condition as to dryness, as also that of the pit shaft, was undoubtedly *much less favourable* than that of dust lodged on the timbers and roadways of mines, where for months or years it has been subjected to an unvarying high temperature and a drying wind.

With reference to the precautionary measures to be taken in the face of these facts, I have again to urge the total abolition of gunpowder from coal mines, and the substitution of certain "high explosives." In this inspection district all the more important firms have already discontinued the use of gunpowder.

Any colliery in which the seams are naturally of a dry and dusty character cannot be successfully damped so as to render gunpowder safe.

In making this report I wish to guard against conveying the impression that all colliery explosions are due to coal dust; no doubt many must be attributed to firedamp, but these are never so devastating and widespreading as those in which coal dust is the explosive agent, for the good reason that in the latter case the dust is frequently co-extensive with the workings of the mine.

Appended hereto are analyses of the air at the bottom of the pit immediately before an experiment, and of the gases in the pit *the instant after an explosion of dust*, also a statement of the hygrometrical condition of the atmosphere on the 17th January, and a careful measurement of the dust in suspension at the instant of firing the shots in the earlier experiments. Some photographs are also sent herewith.

I am, Sir,
Your obedient Servant,
HENRY HALL.

The Right Hon. H. H. Asquith, M.P.,
Secretary of State.

ANALYSIS of AIR IN SHAFT immediately before an experiment.

Nitrogen - - - -	79·3
Oxygen - - - -	20·5
Carbon dioxide - - -	0·2
	100·0

No trace of carbon monoxide or Marsh gas found.
(Signed) W. J. ORSMAN.

ANALYSIS of the GASES in SHAFT during an Explosion.

In order to get some idea of the condition of the air inside the pit during the explosion, samples of air were taken and were analysed. Two brass tubes were fastened to the rope that was used to lower the cannon, one 20 yards from the bottom, the other 40 yards from the bottom.

These tubes were so arranged and constructed that the explosion, as it passed the tubes, unsealed an outlet pipe, and the escaping water sucked in a sample of air which was trapped by a special arrangement and kept in the tube until the rope could be wound up. By this method it was intended that the sample of gas taken should represent the state of the air whilst the flame was passing or directly afterwards.

The tube nearest the bottom, as the analysis will show, did partly collect the gas in the above condition. The tube at the top, however, commenced to act prematurely, and was probably started by the sound wave which preceded the explosion. This tube simply contained ordinary air.

The following is an analysis of the gases found in the lowest tube:—

Oxygen - - - - -	3·9 per cent.
Nitrogen - - - - -	75·9 ,,
Carbon dioxide - - - -	12·1 ,,
Carbon monoxide - - -	8·1 ,,
	100·0

The presence of the above quantity of oxygen is probably due to the apparatus starting working before the flame got to it.

As will be seen, carbon monoxide was formed in some quantity, showing the presence of a large excess of coal dust. This latter fact was further proved by the presence of large volumes of coal dust in the flame at the mouth of the pit.

The above experiment was the first successful attempt to get samples of gas during the progress of explosion, and any further remarks and deductions had better be postponed until further experiments can be made.

Wm. Jas. Orsman, F.I.C., F.C.S.

Dear Sir, 18th January, 1893.

The following are the values of the hygrometer readings taken on Tuesday, at the White Moss Colliery, Skelmersdale, by Mr. Matthews:—

Hygrometer.	Dry.	Wet.	Temperature of Dew Point.	Humidity. Saturation = 100.	Grains of Vapour in a Cubic Foot of the Air.	Grains of Vapour required to saturate a Cubic Foot of the Air.
At beginning - - -	42°	40°	37·5°	85	2·6	0·5. This addition would produce saturation.
At end of experiments - -	38	36	33·3	83	2·2	0·5

The above shows that at the beginning of the experiments the quantity of vapour in the air, in the neighbourhood of the hygrometer, was 85 per cent. of the total quantity required to saturate it, at that temperature; and at the end of the experiments, 83 per cent.

Yours obediently,
James Grundy.

Henry Hall, Esq.,
H.M. Inspector of Mines.

Measurement of Dust in Suspension in the Shaft during the earlier Experiments.

Two hundredweights of dust were put into the shaft, and at the instant a shot would have been fired, a box with a superficial area of one foot was lowered to the bottom of the shaft and allowed to remain there until the dust had entirely settled and the air was clear, the box was then drawn up and the dust lodged upon it weighed. It had collected rather under two ounces, which would represent the dust suspended in a column 50 yards long, with one foot superficial base, or, taking the whole capacity of the shaft, the total amount would be rather less than five pounds.

H. H.

THE ROYAL COMMISSION ON EXPLOSIONS FROM COAL DUST IN MINES.

Photograph to illustrate Mr. Henry Hall's Report

(Appendix XIX.)

WYMAN AND SONS L^TD LITH. LONDON 63137 94

July 8th 1893. *Flame 60 feet high*

3 Cwts. Marton Colliery dust, at rest 25 minutes, Gunpowder fired from an Iron Tube. Hutton Seam.

The Royal Commission on Explosions from Coal Dust in Mines.

Photograph to illustrate Mr. Henry Hall's Report

(Appendix XIX.)

Wyman and Sons Ltd. Lith London 6313.7.94.

July 8th 1893.

Flame 60 feet & spreading

Eppleton Colliery. Main Coal dust from under-ground timbers, fired 1½ lbs. gunpowder 4 minutes after putting dust down.

The Royal Commission on Explosions from Coal Dust in Mines.

Photograph to illustrate Mr. Henry Hall's Report

(Appendix XIX.)

Wyman and Sons Ltd. Lith. London 6313.7.94

July 8th 1893. *Flame 60 feet*

Beamish Busty Dust. 2 cwts used: fired 3 minutes after putting down 1½ lbs. gunpowder from Cannon tamped with Coal-dust.

The Royal Commission on Explosions from Coal Dust in Mines.

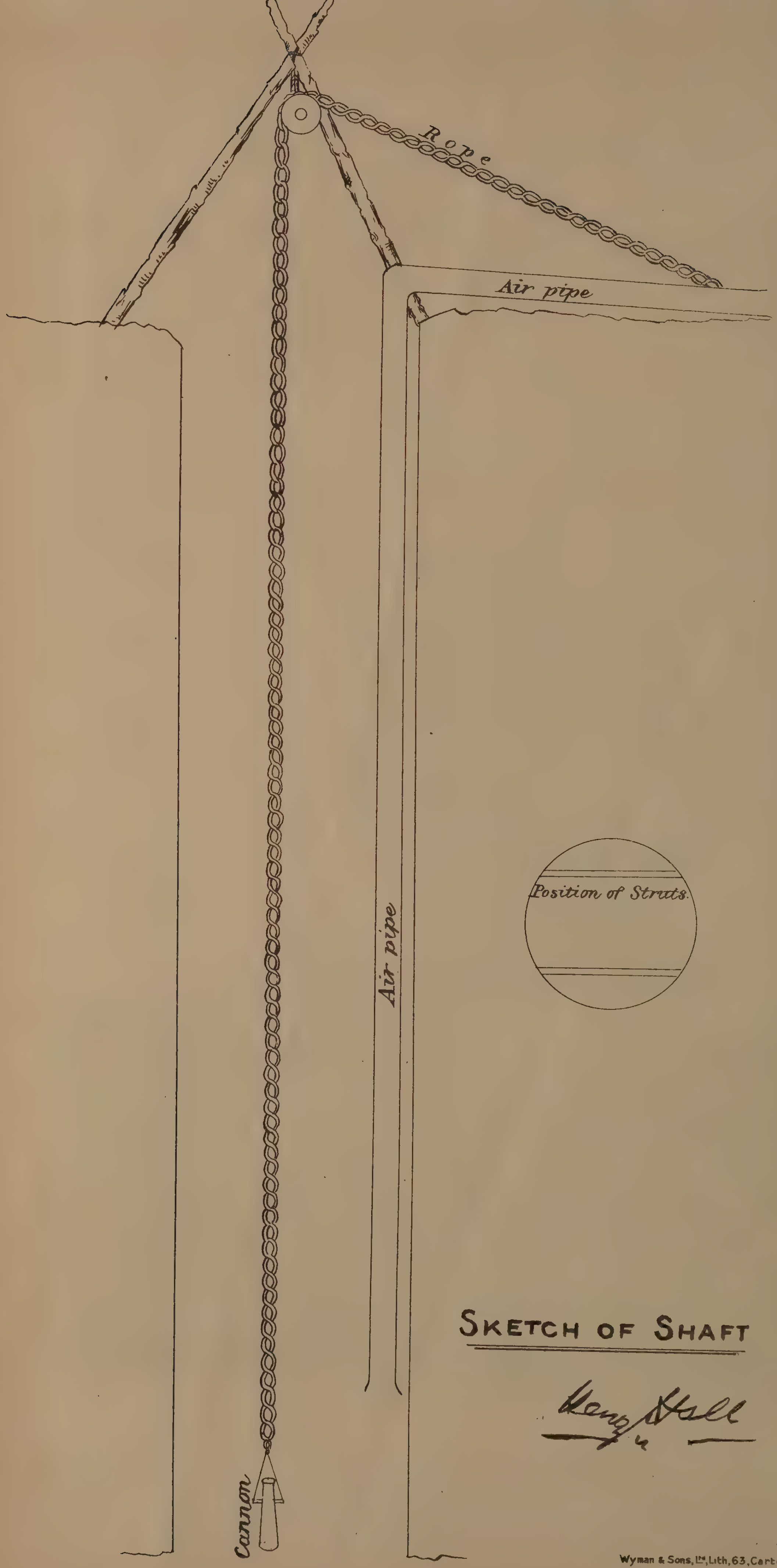
Photograph to illustrate Mr Henry Hall's Report

(Appendix XIX.)

Wyman and Sons Ltd Lith. London 6313.7.94.

July 8th 1893. *Flame 60 feet.*

Beamish Colliery. Busty Seam. 1½ lbs gunpowder fired three minutes after dust was put down, fired from Cannon tamped with Clay.



SKETCH OF SHAFT

Wyman & Sons, Ltd, Lith, 63, Carter Lane. 7.94 6313.

APPENDIX XIX.

Rainhill, Prescot,
20th August, 1893.

SIR,

ON the 29th March last your Commissioners addressed a letter to the Secretary of State suggesting that I should undertake a further series of coal dust experiments to include dusts collected from the principal seams in the respective mining districts, each separate dust to be tested as to its inflammability in the same way as had already been done with certain Lancashire dusts.

I now have the honour to report as to the method adopted to carry out this work and the result of the experiments. In order to keep the experiments within practicable bounds, and at the same time to ensure their being sufficiently extensive and inclusive to be decisive of the characteristics of the dusts which accumulate in and about the roadways in mines in the various coalfields of the kingdom, it was necessary to fix a limit to the number of samples to be tested, and with that object the following code of instructions was drawn up for the guidance of the gentlemen connected with the mines who were kind enough, at the request of the respective inspectors of mines, to undertake the collection of the samples :—

"The dust selected should be that found lodged on the timbering or on ledges underground, or on ledges above the screens on the surface. The dust should be gathered with the hands *and not by shovel*, and should be put in bags containing about a hundredweight. Each separate bag should be placed in a deal box tongued and grooved, and placed in some dry place and at least as warm as the spot where it was collected from. The boiler house or dry storehouse is suitable.

"There must be at least 5 cwts. of any particular variety of dust collected and forwarded, to ensure a fair test of its liability to explosion.

"It is impracticable to test more than four samples from any inspection district, consisting of about 5 cwts. of each variety.

"It is imperative that the dust be fine and dry, and it is suggested that one of the samples should be from the seam of the district which bears the character of being most liable to colliery explosions, and one from the seam considered most safe. Each box should bear a small label in addition to the address label, giving the following particulars :—Weight of dust in cwts. and lbs., name of seam of coal, name of colliery, quality of coal, where and by what means collected, whether from underground or from screens.

"The boxes containing the bags of dust should be forwarded by rail or a covered waggon, and each box should be labelled on the outside as follows :—'Experimental 'coal dust. To be kept dry and immediate delivery. 'To Messrs. The White Moss Colliery Company, Limited, 'Skelmersdale, Ormskirk.'"

The samples of dust were all received in excellent order, some having been gathered from the ledges and timbers underground, others from the underground roads and others again from the timbers over the screens on the surface. In a few cases the dust had been passed through a fine riddle, but there were enough samples in what may be called its raw state from underground roads to ensure that the result of the experiments did not depend on any unusual or artificial conditions. Whatever care and labour may be bestowed on the collection of samples underground, it is, I think, impossible that the sample would be as fine and dry as that floated in the ventilation of a mine and lodged on the timbers about the roof and on all uneven or projecting surfaces of underground roads, and which latter dust is always ready to be lifted and thrown into the air current by any violent rush of air such as might occur through a blasting shot blowing out or in consequence of the ignition of a small body of firedamp.

The samples received for experimental purposes numbered in all 52, coming from 45 different collieries and from 36 separate seams, and with the exception of four or five samples all were tested. An apology is due to the senders of the samples which had to be left over, viz. :—East Hetton, Littleburn, New Seaham, Cannock Chase, and Messrs. Pope and Pearson. Several of the gentlemen who sent dust have been present and witnessed some of the experiments.

The mine shaft, placed at my disposal by the proprietors of White Moss Colliery, Skelmersdale, is the same shaft in which I have made many previous and similar experiments, the results of which have already been brought under your notice. It is 50 yards deep, 7 feet diameter; struts of timber 6 feet long and 7 inches broad are fixed from top to bottom of the shaft at intervals of 6 feet to represent the timbering on an underground roadway. (*See* Plan of Shaft appended.) The ventilation of the shaft is secured by means of a small fan on the surface driven by hand, and forcing fresh air to the bottom of the shaft through 10-inch iron tubes. These tubes reach to within 5 feet of the bottom of the shaft, and the quantity of air passed is about 750 cubic feet pér minute. (Result of analysis of air accompanies Report.) A wrought-iron cannon was used for the gunpowder shots. It measures 2 feet 11 inches in length with a borehole 2 inches in diameter and 2 feet deep, and it was charged in every case with 1½ lbs. of ordinary blasting gunpowder tamped lightly with coal dust. The tamping occupied a space of about 12 inches. The cannon was always charged on the surface, and lowered by means of a rope to the bottom of the shaft and fired in an upright position near the centre of the shaft by means of a detonator in connexion with an electrical firing machine.

The amount of charge of gunpowder used in the experiment, viz., 1½ lbs., was fixed upon as being likely to develop a similar flame to that produced by the accidental ignition of a small quantity of fire-damp in a mine. This charge is somewhat heavier than an average mine shot, but in consequence of the tamping being placed loosely upon the explosive and not rammed home, the shock and violence of the explosion is very inconsiderable as compared with an average mine shot, where the tamping is always rammed home and beaten solid.

Mine shots in this inspection district and used in strong coal amount to as much as 20 ounces or even more, and by reference to the earliest series of these experiments submitted to the Secretary of State (1890), it will be seen that coal-dust explosions resulted from the firing of charges of one pound of gunpowder.

The experiments were commenced on each day by firing two pound charges of gunpowder without dust, so that the onlookers might be better able to judge of the part played by dust in the subsequent experiments.

When a "high explosive" was used it was fired from an iron tube tamped with coal dust, as it was feared the cannon would not bear the shock. In a few cases, in order to make the tests of gunpowder and the high explosives precisely the same, the gunpowder charge was fired from an iron tube exactly similar to that used for the high explosive, and in two or three cases, it will be noticed that the cannon was tamped *with clay in place of coal dust*.

The conditions under which each sample was tested were kept as nearly as possible the same in every case. Usually the sample was first tested *in suspension*, that is, the shot was fired with some of the dust floating in the air in the shaft; this state of things was considered most favourable to an explosion of the dust. If this experiment resulted in an explosion then the same sample was again tested *at rest*, that is, an interval of 15 or 20 minutes was allowed to elapse after putting the dust down and before firing the shot, the dust having by that time settled, part on the timbers and the remainder at the bottom of the shaft, and if an explosion resulted under these conditions, the tests of that particular sample were considered complete.

I found by a careful collection and weighing of the dust resting on the timbers after putting down 2 cwts., that these timbers afforded a lodgment for about 80 pounds of dust, and I am of opinion that this portion only of the 2 cwts. put down was exploded and gave rise to the whole of the phenomena exhibited by the explosions.

When the testing of a sample was complete, one or two what may be called "blank shots" were fired in the shaft to blow out any remnants of dust before the testing of a new sample was commenced.

The experiments occupied 12 days, the weather throughout being most favourable, and on several days there was an unusual difference between the wet and dry thermometers showing the atmosphere to be very dry. (*See* accompanying description of the weather.)

In the list of experiments which follow, the tests for each county are collected together in preference to giving the details in the consecutive order of the experiments themselves.

NORTHUMBERLAND.

Date of Experiment.	Colliery from which Dust was collected.	Name of Seam.	Condition of Dust.	How collected and whether from Underground or Screens.	Weight of Dust used in Experiment.	Weight of Explosive used.	Dust in Suspension or at Rest.	Interval between putting in Dust and Firing Shot.	Result.	Previous History of Seam as regards Explosions.
								m. s.		
June 24 -	Walker -	Beaumont -	Brown and rough.	Collected off timbers underground.	1½ cwts. -	1½ lb. G.P.	In suspension	3 0	Violent explosion and flame 30 feet above pit - -	An explosion occurred at this colliery in 1887, killing two men, and in 1890 an explosion at Hebburn in the same seam, killing four or five persons.
Do. -	Do. -	Do. -	Very dirty, not the same as above.	Do. -	1½ cwts. -	1½ lb. G.P.	At rest -	16 0	No explosion - - -	
Do. -	Cambois -	Low main -	Brown, rough, and dirty.	Not stated. Believed to be from screens.	2 cwts. -	1½ lb. G.P.	In suspension	6 0	Violent explosion and flame 30 feet above pit - -	No explosion has occurred at this colliery or at the collieries in the neighbourhood working the seam. This seam corresponds with the Hutton seam in Durham, in which there have been frequent explosions.
Do. -	Do. -	Do. -	Do. -	Do. -	2 cwts. -	1½ lb. G.P.	At rest -	15 0	Very violent explosion and flame 40 feet above pit -	
Do. -	Do. -	Do. -	Do. -	Do. -	None added	1½ lb. G.P.	At rest -	30 0	Explosion flame just showing at pit top - - - *Note.*—No dust put in after last explosion.	

DURHAM.

Date of Experiment.	Colliery from which Dust was collected.	Name of Seam.	Condition of Dust.	How collected and whether from Underground or Screens.	Weight of Dust used in Experiment.	Weight of Explosive used.	Dust in Suspension or at Rest.	Interval between putting in Dust and Firing Shot.	Result.	Previous History of Seam as regards Explosions.
June 9 -	Hetton -	Hutton -	Fine and black	Collected by hand from timbers and ledges underground.	1½ cwts. -	1½ lb. G.P.	In suspension	2 30	Explosion and great flame, but sluggish.	There was an explosion at this colliery in 1862.
Do. -	Do. -	Do. -	Do. -	Do. -	1½ cwts. -	1½ lb. G.P.	At rest -	15 0	Very violent explosion and flame 40 feet above pit top.	
June 23 -	Usworth -	Maudlin -	Do. -	Collected from the timbers underground and riddled.	2 cwts. -	1½ lb. G.P.	At rest -	25 0	Explosion and flame 30 feet above pit top - -	An explosion occurred at this Usworth colliery in the Maudlin seam in 1885, killing 42 persons. *See* Messrs. Atkinson's treatise on "Colliery Explosions."
Do. -	Do. -	Do. -	Do. -	Do. -	2 cwts. -	1½ lb. G.P.	In suspension	3 0	Very violent explosion and flame 50 feet above pit top -	
Do. -	Silksworth -	Do. -	Do. -	Collected from timbers and sidewalls underground.	2 cwts. -	1½ lb. G.P.	In suspension	3 0	Very violent explosion and flame 60 feet above pit top.	There has been no explosion at Silksworth Colliery. Same seam in which the explosion at Usworth took place.

DURHAM—*continued.*

Date of Experiment.	Colliery from which Dust was collected.	Name of Seam.	Condition of Dust.	How collected and whether from Underground or Screens.	Weight of Dust used in Experiment.	Weight of Explosive used.	Dust in Suspension or at Rest.	Interval between putting in Dust and Firing Shot.	Result.	Previous History of Seam as regards Explosions.
								m. s.		
June 23 -	Silksworth	Maudlin -	Fine and black	Collected from timbers and sidewalls underground.	2 cwts. -	8 oz. Roburite.	In suspension	3 0	No explosion or charring - *Note.*—Roburite.	There has been no explosion at Silksworth colliery. Same seam in which the explosion at Usworth took place.
Do. -	Do. -	Do. -	Do. -	Do. -	None added	1½ lb. G.P.	At rest -	20 0	No explosion, charring 11 yards - - -	
June 24 -	Seaham -	Hutton -	Brown and dirty.	Collected by hand from timbers underground.	2 cwts. -	1¼ lb. G.P.	In suspension	3 0	Explosion and flame at top of pit - - -	An explosion in this seam in 1871 killing 26 persons, another in 1880 killing 164 persons. I believe a third explosion has occurred at this colliery in recent years.
Do. -	Do. -	Do. -	Fine and black	Collected at screens.	1 cwt. -	1½ lb. G.P.	In suspension	3 0	Violent explosion and flame 30 feet above pit top -	
Do. -	Auckland Park.	Harvey -	Very rough and lumpy, rather brown.	Collected from engine plane underground.	1½ cwt. -	8 oz. Roburite.	In suspension	3 0	No explosion or charring - *Note.*—Roburite.	No explosion has taken place at this colliery.
Do. -	Do. -	Do. -	Do. -	Do. -	None added	1½ lb. G. P.	At rest -	15 0	No explosion, charring 7 yards	
Do. -	Do. -	Do. -	Do. -	Do. -	1½ cwts. -	1½ lb. G. P.	In suspension	2 30	No explosion, charring 15 yards - - -	
July 6 -	Brancepeth	5/4 or Jet -	Fine and black.	Collected from bars and sides underground.	1 cwt. -	1½ lb. G. P.	In suspension	3 0	Very violent explosion and flame 60 feet above pit top -	No explosion is recorded as occurring at this colliery, but three persons were killed by an explosion of dust in a coal hopper.
Do. -	Do. -	—	Do. -	Collected from hopper on surface.	2 cwts. -	1½ lb. G. P.	At rest -	15 0	Most violent explosion and flame 40 feet above pit top -	
Do. -	Do. -	—	Do. -	Do. -	None added	1½ lb. G. P.	At rest -	30 0	Explosion and flame 30 feet above pit top - - *Note.*—No dust put in after last explosion.	
Do. -	Trimdon Grange.	Harvey -	Brown and rough.	Collected off rolley - ways underground.	2 cwts. -	1½ lb. G. P.	In suspension	3 0	No explosion, s ght charring -	This colliery was the scene of a disastrous explosion in 1882, killing 74 persons. *Note.*—This dust was not persevered with as Durham had taken up so much time.

DURHAM—*continued.*

Date of Experiment	Colliery from which Dust was collected.	Name of Seam.	Condition of Dust.	How collected and whether from Underground or Screens.	Weight of Dust used in Experiment.	Weight of Explosive used.	Dust in Suspension or at Rest.	Interval between putting in Dust and Firing Shot.	Result.	Previous History of Seam as regards Explosions.
								m. s.		
July 8	Murton	Hutton	Fine and black.	Collected from screens and small coal apparatus.	$1\frac{1}{2}$ cwts.	$1\frac{1}{2}$ lb. G. P.	In suspension	3 0	Very violent explosion and flame 50 feet above pit top	No explosions recorded at this colliery, but the two at Seaham were in this seam and others in past years. *Note.*—All three explosives were fired from an iron tube and not from the cannon.
Do.	Do.	Do.	Do.	Do.	$1\frac{1}{2}$ cwts.	10 oz. Ammonite.	In suspension	3 0	Missed fire	
Do.	Do.	Do.	Do.	Do.	$1\frac{1}{2}$ cwts.	10 oz. Ammonite.	In suspension	3 0	No explosion or charring *Note.*—Ammonite.	
Do	Do.	Do.	Do.	Do.	None added	8 oz. Roburite.	At rest	11 0	No explosion or charring *Note.*—Roburite.	
Do.	Do.	Do.	Do.	Do.	None added	$1\frac{1}{2}$ lb. G. P.	At rest	25 0	Very violent explosion and flame 60 feet above pit top	
Do.	Beamish	Busty	Do.	From screens	2 cwts.	$1\frac{1}{2}$ lb. G. P.	In suspension	3 0	Very violent explosion and flame 60 feet above pit top, also spreading horizontally about 12 yards.	
Do.	Do.	Do.	Do.	Do.	2 cwts.	$1\frac{1}{2}$ lb. G. P.	In suspension	3 0	Very violent explosion and flame 60 feet above pit top, also spreading about 10 yards horizontally	*Note.*—Cannon tamped with clay instead of coal-dust.
Do.	Do.	Do.	Do.	Do.	None added	$1\frac{1}{2}$ lb. G. P.	At rest	20 0	Violent explosion and flame 30 feet above pit top *Note.*—No dust put in after last explosion.	There has been no explosion at Beamish, but one in the same seam at West Stanley, killing 13 persons.
Do.	Eppleton	Main Coal	Fine but brown	Collected from timbers underground.	2 cwts.	$1\frac{1}{2}$ lb. G.P.	In suspension	4 0	Very violent explosion and flame 60 feet above pit top, also spreading horizontally about 10 yards.	An explosion occurred in this colliery many years ago.

YORKSHIRE.

Date of Experiment.	Colliery from which Dust was collected.	Name of Seam.	Condition of Dust.	How collected and whether from Underground or Screens.	Weight of Dust used in Experiment.	Weight of Explosive used.	Dust in Suspension or at Rest.	Interval between putting in Dust and Firing Shot. m.	s.	Result.	Previous History of Seam as regards Explosions.
May 13 -	Aldwarke Main.	Parkgate -	Fine and black	Collected from beams and rafters at screens.	1¾ cwts. -	1½ lb. G.P.	In suspension	2	0	Violent explosion and flame 40 feet above pit top -	No explosion has occurred in this seam at the Aldwarke Main Colliery in recent years; there was one in 1875 killing seven persons.
Do. -	Do. -	Do. -	Do. -	Do. -	1 cwt. -	8 oz. Roburite.	In suspension	2	0	No explosion or charring - *Note.*—Roburite.	
Do. -	Do. -	Do. -	Do. -	Do. -	None added	8 oz. Roburite.	At rest -	15	0	No explosion or charring - *Note.*—Roburite.	
Do. -	Do. -	Do. -	Do. -	Do. -	Do.	1½ lb. G.P.	At rest -	40	0	No explosion, charring 7 yards	
Do. -	Do. -	Do. -	Do. -	Do -	Do.	1½ lb. G.P.	At rest -	150	0	No explosion or charring - *Note.*—This shot was fired to clear pit of dust -	
July 6	Do. -	Do. -	Do. -	Do. -	1½ cwts. -	1½ lb. G.P.	At rest -	15	0	No explosion, charring 15 yards -	
Do. -	Do. -	Do. -	Do. -	Do. -	1 cwt. -	1½ lb. G.P.	In suspension	3	0	Quick explosion and flame 30 feet above pit top -	
June 22 -	Peckfield -	Beeston -	Do. -	Collected underground.	2 cwts. -	1½ lb. G.P.	At rest -	15	0	Violent explosion and flame 30 feet above pit top. This shot burst the cannon -	There have been several explosions in this seam attended with loss of life, but nothing very sweeping in character.
Do. -	Do. -	Do. -	Do. -	Do. -	2 cwts. -	1½ lb. G.P.	In suspension	2	30	Very violent quick explosion. This shot was fired from an iron tube -	
Do. -	Do. -	Do. -	Do. -	Do. -	1 cwt. -	8 oz. Roburite.	In suspension	2	30	No explosion or charring; this shot was fired from iron tube.—Roburite -	
Do. -	Do. -	Do. -	Do. -	Do. -	None added	1½ lb. G.P.	At rest -	20	0	Explosion, but flame did not reach top of pit, charring 27 yards. This shot was fired from iron tube -	
July 6 -	Mitchell's Main.	Barnsley Bed.	Do. -	Collected in intake airways underground.	2 cwts. -	1½ lb. G.P.	In suspension	3	0	Explosion and flame 20 feet above pit top -	No explosion at Mitchell's Main, but at several neighbouring collieries in the same seam there have been disastrous explosions, viz., Oaks, Edmund's Main, Swaithe Main, and Darley Main, by which some hundreds of persons lost their lives. The Barnsley Bed is considered the most dangerous seam in Yorkshire.
Do. -	Do. -	Do. -	Do. -	Collected at screens.	2 cwts.	1½ lb. G.P.	In suspension	3	0	Very violent explosion and flame 50 feet above pit top -	

DERBYSHIRE.

Date of Experiment.	Colliery from which Dust was collected.	Name of Seam.	Condition of Dust.	How collected and whether from Underground or Screens.	Weight of Dust used in Experiment.	Weight of Explosive used.	Dust in Suspension or at Rest.	Interval between putting in Dust and Firing Shot.	Result.	Previous History of Seam as regards Explosions.
								m. s.		
July 7 -	Clay Cross	Silkstone -	Fine and brown.	Collected from pack walls and haulage roads underground.	2 cwts. -	$1\frac{1}{2}$ lb. G.P.	In suspension	3 0	Very violent explosion and flame 60 feet above pit top -	An explosion occurred in 1882 killing 45 persons.
Do. -	Do. -	Do. -	Do. -	Do. -	2 cwts. -	$1\frac{1}{2}$ lb. G.P.	At rest -	15 0	No explosion, charring 9 yards	
Do.	Blackwell -	Deep Hard	Black, rather rough.	Collected from sides and timbers underground.	$1\frac{3}{4}$ cwts. -	$1\frac{1}{2}$ lb. G.P.	In suspension	3 0	Slow but violent explosion, and flame 40 feet above pit top - - - -	No explosions have occurred in the Deep Hard Seam at this or neighbouring collieries.
July 8 -	Do. -	Do. -	Do. -	Do. -	2 cwts. -	$1\frac{1}{2}$ lb. G.P.	In suspension	3 0	No explosion, charring 20 yards - - -	
Do. -	Do. -	Do. -	Do. -	Do. -	2 cwts. -	$1\frac{1}{2}$ lb. G.P.	In suspension	3 0	No explosion, charring 27 yards - - -	
Do. -	Birley -	Silkstone -	Fine and black.	Collected from screens.	2 cwts. -	$1\frac{1}{2}$ lb. G.P.	In suspension	3 0	Very violent, quick explosion, and flame 40 feet above pit top - - - -	Explosion in 1876 killing six persons. This seam is the same as the Yorkshire Silkstone.
Do. -	Do. -	Do. -	Do. -	Do. -	2 cwts. -	$1\frac{1}{2}$ lb. G.P.	At rest -	16 0	Very violent explosion, and flame 50 feet above pit top	
Do. -	Do. -	Do. -	Do. -	Do. -	None added	$1\frac{1}{2}$ lb. G.P.	At rest -	40 0	Explosion and flame 10 feet above pit top - - *Note.*—No dust was put in after last shot.	

NOTTINGHAMSHIRE.

Date of Experiment.	Colliery from which Dust was collected.	Name of Seam.	Condition of Dust.	How collected and whether from Underground or Screens.	Weight of Dust used in Experiment.	Weight of Explosive used.	Dust in Suspension or at Rest.	Interval between putting in Dust and Firing Shot.	Result.	Previous History of Seam as regards Explosions.
July 7 -	Annesley -	Top Hard -	Fine and black.	Collected from timbers underground and from return airways.	2 cwts. -	$1\frac{1}{2}$ lb. G.P.	In suspension	3 0	Slow explosion, with much flame, rising 40 feet above top of pit - - -	No explosions recorded. This seam is said to be the Yorkshire Barnsley Bed.
Do. -	Do. -	Do. -	Do. -	Do. -	2 cwts. -	$1\frac{1}{2}$ lb. G.P.	At rest -	15 0	Slow explosion, with much flame, rising 40 feet above pit top - - -	

STAFFORDSHIRE.

Date of Experiment.	Colliery from which Dust was collected.	Name of Seam.	Condition of Dust.	How collected and whether from Underground or Screens.	Weight of Dust used in Experiment.	Weight of Explosive used.	Dust in Suspension or at Rest.	Interval between putting in Dust and Firing Shot.	Result.	Previous History of Seam as regards Explosions.
								m. s.		
May 12 -	Great Fenton.	Great Row	Fine, but of a brown grey colour.	Collected off roof timbers in drawing road underground.	2 cwts. -	1½ lb. G.P.	In suspension	2 0	No explosion, slight charring	No explosion is recorded as occurring in this seam.
Do. -	Do. -	Do. -	Do. -	Do. -	1¾ cwts. -	1½ lb. G.P.	In suspension	2 0	Do. do. -	
Do. -	Do. -	Do. -	Do. -	Do. -	None added	1½ lb. G.P.	At rest -	10 0	No explosion - - -	
Do. -	Leycett -	7-ft. Banbury.	Fine, but grey	Collected from floor in return airway underground 100 yards from upcast pit.	2 cwts. -	1½ lb. G.P.	In suspension	3 30	Explosion and flame 20 feet above pit top - -	There have been four explosions in the 7-feet Banbury since 1875, killing 80 persons, principally at Leycett Colliery.
Do. -	Do. -	Do. -	Do. -	Do. -	2 cwts. -	1½ lb. G.P.	At rest -	20 0	Explosion, but flame did not quite reach pit top - -	
May 13 -	Whitfield -	Cockshead -	Fine and black.	Collected at screens.	2 cwts. -	1½ lb. G.P.	In suspension	2 0	Explosion, but flame did not reach pit top - -	There have been seven explosions in this seam since 1872, killing 184 persons. Banker's Hill was the most extensive, killing 43 persons, and Mossfield in 1889, killing 64 persons.
Do. -	Do. -	Do. -	Do. -	Do. -	2 cwts. -	1½ lb. G.P.	In suspension	2 0	Very violent explosion and a mass of flame over pit top -	
June 23 -	West Cannock.	Shallow -	Grey and mixed with clay.	Collected in return airway underground near upcast pit.	2 cwts. -	1½ lb. G.P.	In suspension	2 30	No explosion or charring -	A local explosion occurred at this colliery in 1887 in the attempt to stop off a fire underground; three persons were burnt to death but the explosive effects did not extend more than a few yards.
Do. -	Do. -	Do. -	Do. -	Do. -	1 cwt -	1½ lb. G.P.	In suspension	2 0	Do. do. -	
June 22 -	Talk o' th' Hill.	Bullhurst -	Black, but very rough.	Collected from timbers underground.	2 cwts. -	1½ lb. G.P.	At rest -	15 0	No explosion, 15 yards charring - - -	There have been three explosions in this seam since 1873, killing 33 persons, viz., Bignall Hill, 17 persons; Leycett, 6; and in 1891, Apedale, killing 10 persons.
Do. -	Do. -	Do. -	Do. -	Do. -	1½ cwts. -	1½ lb. G.P.	In suspension	2 0	No explosion, 17 yards charring - - -	
Do. -	Do. -	Do	Do. -	Do. -	1½ cwts. -	1½ lb. G.P.	In suspension	1 0	No explosion, 11 yards charring - - -	

LANCASHIRE.

Date of Experiment.	Colliery from which Dust was collected.	Name of Seam.	Condition of Dust.	How collected and whether from Underground or Screens.	Weight of Dust used in Experiment.	Weight of Explosive used.	Dust in Suspension or at Rest.	Interval between putting in Dust and Firing Shot. m.	s.	Result.	Previous History of Seam as regards Explosions.
May 12 -	White Moss	Park -	Fine and black.	Collected off timbers above screens.	1¾ cwts. -	8 oz. Roburite.	In suspension	3	0	No explosion or charring - *Note.*—Roburite.	No explosion of a serious nature has occurred at this colliery or at the neighbouring collieries working the same seam.
Do. -	Do. -	Do. -	Do.	Do. -	None added	1½ lb. G. P.	At rest -	20	0	Very violent explosion and flame 40 feet above pit top -	
May 13 -	Atherton -	Arley -	Do. -	Collected by hand underground.	1¾ cwts. -	1½ lb. G. P.	In suspension	1	30	Very violent explosion and volumes of flame rising 30 or 40 feet above pit top -	No explosion has occurred at the Atherton Colliery, but at collieries in the Wigan district, and working the same seam, there have been several sweeping explosions attended with great loss of life. This seam has been the most fatal of any in Lancashire. (*See* Mr. Southworth's letter below.)
Do. -	Do. -	Do. -	Do. -	Do. -	1 cwt. -	1½ lb. G. P.	At rest -	45	0	Very violent explosion and volumes of flame rising 30 feet above pit top - -	
May 27 -	Do. -	Do. -	Do. -	Do. -	2 cwts. -	1½ lb. G. P.	In suspension	2	0	Very violent explosion and flame 30 feet above pit top -	
Do. -	Do. -	Do. -	Do. -	Do. -	1 cwt. -	1½ lb. G. P.	At rest -	20	0	No explosion, 7 yards charring	
Do. -	Moston -	Big Mine -	Do. -	Collected from pack walls and ledges underground and riddled.	2 cwts. -	1½ lb. G. P.	In suspension	2	0	No explosion, 11 yards charring - - -	No explosion has occurred in this colliery or in neighbouring collieries working the same seam.
Do. -	Do. -	Do. -	Do. -	Do. -	1 cwt. 9 lbs.	1½ lb. G. P.	In suspension	2	0	No explosion, 8 yards charring	
Do. -	Do. -	Do. -	Do. -	Do. -	1¼ cwts. -	1½ lb. G. P.	In suspension	1	30	No explosion, 8 yards charring	
Do. -	Astley and Tyldesley.	Crombouke	Fine but gray in colour.	Collected from ledges and timbers underground.	2 cwts. -	1½ lb. G. P.	In suspension	2	0	No explosion, 8 yards charring	Not stated.
Do. -	Do. -	Do. -	Do. -	Do. -	None added	1½ lb. G. P.	At rest -	20	0	No explosion or charring -	
Do. -	Clifton Hall	Trencher-bone.	Fine and black.	Collected from screens.	1¼ cwts. -	8 oz. Roburite.	In suspension	2	0	No explosion or charring *Note.*—Roburite.	There was an extensive explosion at this colliery in 1885, killing 178 persons. This seam corresponds with the fatal Wigan 6 feet, in which there have been many sweeping explosions.
Do. -	Do. -	Do. -	Do. -	Do. -	1¼ cwts. -	1½ lb. G. P.	In suspension	2	0	Most violent explosion and flame 50 or 60 feet above pit top - - -	
Do. -	Do. -	Do. -	Very gray and heavy, mostly metal dust.	Collected a mile underground.	1½ cwts. -	1½ lb. G. P.	In suspension	1	30	No explosion, slight charring	
June 22 -	Do. -	Do. -	Fine and black.	Collected from screens.	1½ cwts. -	1½ lb. G. P.	In suspension	3	0	Very violent explosion and flame 50 feet above pit top. This shot was fired from iron tube.	

LANCASHIRE—*continued.*

Date of Experiment.	Colliery from which Dust was collected.	Name of Seam.	Condition of Dust.	How collected and whether from Underground or Screens.	Weight of Dust used in Experiment.	Weight of Explosive used.	Dust in Suspension or at Rest.	Interval between putting in Dust and Firing Shot.	Result.	Previous History of Seam as regards Explosions.
								m. s.		
July 8 -	Moss -	Wigan 6 feet or Trencherbone.	Brown and dirty.	Collected from haulage roads underground.	2 cwts. -	$1\frac{1}{2}$ lb. G. P.	In suspension	3 0	Slow explosion and flame 20 feet above pit top - -	This seam is the same as the Trencherbone in the Manchester district, and has been the scene of many disastrous explosions in the neighbourhood of Wigan and Manchester, killing some hundreds of persons.
Do. -	Do. -	Do. -	Do. -	Do. -	$2\frac{1}{2}$ cwts. -	$1\frac{1}{2}$ lb. G. P.	At rest -	15 0	Slow explosion and flame 6 feet above pit top - -	

GLAMORGANSHIRE.

Date of Experiment.	Colliery from which Dust was collected.	Name of Seam.	Condition of Dust.	How collected and whether from Underground or Screens.	Weight of Dust used in Experiment.	Weight of Explosive used.	Dust in Suspension or at Rest.	Interval between putting in Dust and Firing Shot.	Result.	Previous History of Seam as regards Explosions.
June 8 -	Morfa -	Cribbar -	Fine, but brown -	Collected from timbers and faces underground.	2 cwts. -	$1\frac{1}{2}$ lb. G.P.	In suspension	1 30	Violent explosion and flame 30 feet above pit top -	There was an explosion in this seam at Morfa in 1863, killing 30 persons, and another in 1890, killing 87 persons.
Do. -	Do. -	Do. -	Do. -	Do. -	$1\frac{1}{2}$ cwts. -	$1\frac{1}{2}$ lb. G.P.	At rest -	15 0	Violent explosion and flame 30 feet above pit top -	
Do. -	Albion -	Merthyr or Aberdare 4 ft. -	Fine and black.	Collected by hand underground.	2 cwts. -	$1\frac{1}{2}$ lb. G.P.	In suspension	1 30	Most violent explosion and flame 50 feet above pit top -	There has been no explosion at Albion Colliery, but at collieries in the South Wales District working the Merthyr 4 ft. seam there have been many disastrous explosions. The loss of life by explosions in that seam since 1845 amounts to upwards of 1,600 persons. This seam has proved more fatal as regards explosions than any other seam in the kingdom.
Do. -	Do. -	Do. -	Do. -	Do. -	$1\frac{1}{2}$ cwts. -	8 oz. Roburite.	In suspension	1 30	No explosion or charring. - *Note.*—Roburite.	
Do. -	Do. -	Do. -	Do. -	Do. -	None added	$1\frac{1}{2}$ lb. G.P.	At rest -	15 0	Most violent explosion and flame 50 feet above pit top -	
June 9 -	Do. -	Do. -	Do. -	Do. -	$1\frac{1}{2}$ cwts. -	$1\frac{1}{2}$ lb. G.P.	At rest -	18 0	Most violent explosion yet recorded, and flame 50 feet above pit top - -	
July 6 -	Do. -	Do. -	Do.	Collected from screens.	2 cwts. -	$1\frac{1}{2}$ lb. G.P.	In suspension	3 0	Very violent explosion and flame 60 feet above pit top - *Tamped with clay.*	
Do. -	Do. -	Do. -	Do. -	Collected underground.	2 cwts. -	$1\frac{1}{2}$ lb. G.P.	At rest -	30 0	Very violent explosion and flame 60 feet above pit top -	
Do. -	Do. -	Do. -	Do. -	Do. -	None added	$1\frac{1}{2}$ lb. G.P.	At rest -	45 0	Explosion and flame 15 feet above pit top - - *Note.*—No dust put in after last explosion.	

GLAMORGANSHIRE—*continued.*

Date of Experiment.	Colliery from which Dust was collected.	Name of Seam.	Condition of Dust.	How collected and whether from Underground or Screens.	Weight of Dust used in Experiment.	Weight of Explosive used.	Dust in Suspension or at Rest.	Interval between putting in Dust and Firing Shot. m. s.	Result.	Previous History of Seam as regards Explosions.
June 23 -	Lewis' Merthyr.	Aberdare 4ft.	Fine and brown.	Collected from intake airways underground.	2 cwts. -	1½ lb. G.P.	At rest -	15 0	Explosion and flame just reached top of pit - -	There has been no explosion of consequence at Lewis' Merthyr, but the seam is the fatal Merthyr or Aberdare 4 ft.
Do. -	Do. -	Do. -	Do. -	Do. -	1 cwt. -	1½ lb. G.P.	In suspension	3 0	No explosion, charring 15 yards	
Do. -	Do. -	Do. -	Do. -	Do. -	1 cwt. -	1½ lb. G.P.	In suspension	1 30	No explosion, charring 17 yards	
July 6 -	Llnywpia -	No. 3 Rhondda. -	Fine and black.	Not stated.	2 cwts. -	1½ lb. G.P.	In suspension	3 0	Most violent explosion and flame 60 feet above pit top	No explosion has occurred at Llnywypia Colliery, but 28 men were killed in the same seam at Dinas in 1844, and an explosion in the same seam at Cymauer Colliery in 1856, when 114 persons were killed.
July 7 -	Do.	Do. -	Do. -	Do. -	2 cwts. -	8 oz. Roburite.	In suspension	3 0	No explosion or charring - *Note.*—Roburite.	
Do. -	Do. -	Do. -	Do. -	Do. -	None added	1½ lb. G.P.	At rest -	18 0	Most violent explosion and flame 60 feet above pit top	
Do. -	Do. -	Do. -	Do. -	Do. -	1½ cwts. -	10 oz. Ammonite.	At rest - -	12 0	No explosion or charring - *Note.*—Ammonite.	
Do. -	Do. -	Do. -	Do. -	Do. -	None added	1½ lb. G.P.	At rest -	30 0	Very violent explosion and flame 50 feet above pit top -	
June 9 -	Gwaun-cae-Gurwen.	Big Vein -	Fine and black.	Collected from a crusher on surface.	2 cwts. -	1½ lb. G.P.	In suspension	1 30	No explosion, charring 14 yards	This is an Anthracite colliery; there has never been any extensive explosion in it. The only explosion recorded is one in 1886, injuring three persons.
Do. -	Do. -	Do. -	Do. -	Do. -	1¾ cwts. -	1½ lb. G.P.	In suspension	3 0	No explosion, charring 12 yards	
Do. -	Do. -	Do. -	Do. -	Do. -	1¾ cwts. -	1½ lb. G.P.	In suspension	5 0	No explosion, charring 8 yards	
Do. -	Do. -	Do. -	Do. -	Do. -	None added	1½ lb. G.P.	At rest -	30 0	No explosion, charring 9 yards	

MONMOUTHSHIRE.

Date of Experiment.	Colliery from which Dust was collected.	Name of Seam.	Condition of Dust.	How collected and whether from Underground or Screens.	Weight of Dust used in Experiment.	Weight of Explosive used.	Dust in Suspension or at Rest.	Interval between putting in Dust and Firing Shot. m. s.	Result.	Previous History of Seam as regards Explosions.
June 8 -	Celynen -	Black Vein -	Fine and brown	Collected from sides and floor underground.	2 cwts. -	1½ lb. G.P.	In suspension	1 45	Explosion in shaft, but no flame at top -	There has been no explosion at Celynen, but the seam is the Risca Black Vein, in which there have been several disastrous explosions, one at Risca, in 1880, killing 119 persons.
Do. -	Do. -	Do. -	Do. -	Do. -	1 cwt. -	1½ lb. G.P.	In suspension	1 0	Miss-fire - - -	
Do. -	Do. -	Do. -	Do. -	Do. -	None added	1½ lb. G.P.	At rest -	23 0	Very violent explosion, and flame 40 feet above pit top - - -	
Do. -	Llanerch -	Meadow -	Brown, gray, mixed with stones.	Collected in return airways underground.	2 cwts. -	1½ lb. G.P.	In suspension	2 0	No explosion, charring 7 yards	There have been two explosions at Llanerch, one killing seven persons, and the other, in 1890, killing 176 person.
Do. - -	Do. -	Do. -	Do. -	Do. -	1¾ cwts. -	1½ lb. G.P.	In suspension	1 30	No explosion, charring 8 yards	

SOMERSETSHIRE.

Date of Experiment.	Colliery from which Dust was collected.	Name of Seam.	Condition of Dust.	How collected and whether from Underground or Screens.	Weight of Dust used in Experiment.	Weight of Explosive used.	Dust in Suspension or at Rest.	Interval between putting in Dust and Firing Shot.	Result.	Previous History of Seam as regards Explosions.
July 7	Radstock	No. 6	Brown and rough.	Collected from sides and timbers underground.	2 cwts.	$1\frac{1}{2}$ lb. G.P.	In suspension	m. s. 3 0	No explosion, charring 25 yards	No explosions have occurred in this seam. It is stated to be absolutely free from firedamp.
Do.	Do.	Do.	Do.	Do.	2 cwts.	$1\frac{1}{2}$ lb. G.P.	In suspension	3 0	No explosion, but charring extended 40 yards up the shaft	

FOREST OF DEAN.—GLOUCESTERSHIRE.

Date of Experiment.	Colliery from which Dust was collected.	Name of Seam.	Condition of Dust.	How collected and whether from Underground or Screens.	Weight of Dust used in Experiment.	Weight of Explosive used.	Dust in Suspension or at Rest.	Interval between putting in Dust and Firing Shot.	Result.	Previous History of Seam as regards Explosions.
May 13	Lightmoor	Rocky	Fine, but brown	Collected from main haulage roads underground.	2 cwts.	$1\frac{1}{2}$ lb. G.P.	In suspension	2 0	No explosion, charring 11 yards	It is stated that there has never been an explosion in the Forest of Dean, where this colliery is situate; also that the seam is entirely free from firedamp.
Do.	Do.	Do.	Do.	Do.	$1\frac{1}{2}$ cwts.	$1\frac{1}{2}$ lb. G.P.	In suspension	3 0	No explosion, charring 11 yards	
Do.	Do.	Do.	Do.	Do.	None added	$1\frac{1}{2}$ lb. G.P.	At rest	30 0	No explosion or charring	
Do.	Do.	Do.	Do.	Do.	$1\frac{3}{4}$ cwts.	$1\frac{1}{2}$ lb. G.P.	In suspension	1 30	No explosion, charring 6 yards	
July 7	Do.	Do.	Do.	Do.	2 cwts.	$1\frac{1}{2}$ lb. G.P.	In suspension	3 0	No explosion, charring 20 yards	
Do.	Do.	Do.	Do.	Do.	2 cwts.	$1\frac{1}{2}$ lb. G.P.	In suspension	3 0	No explosion, charring 26 yards	

SCOTLAND.

Date of Experiment.	Colliery from which Dust was collected.	Name of Seam.	Condition of Dust.	How collected and whether from Underground or Screens.	Weight of Dust used in Experiment.	Weight of Explosive used.	Dust in Suspension or at Rest.	Interval between putting in Dust and Firing Shot.	Result.	Previous History of Seam as regards Explosions.
								m. s.		
June 9 -	Udston -	Splint -	Fine, but brown.	Collected underground and riddled.	1½ cwts. -	1½ lb. G.P.	In suspension	2 0	Very violent explosion and flame 30 feet above pit top -	Explosion at Udston in this seam in 1887. Killing all the men except two and all the horses, this explosion extended throughout the whole area of the workings. The loss of life amounted to 70 or 80 persons.
Do. -	Do. -	Do. -	Do. -	Do. -	1½ cwts. -	1½ lb. G.P.	At rest - -	17 0	Explosion with much flame but rather sluggish -	
June 24 -	Do. -	Do. -	Do. -	Do. -	1 cwt. -	1½ lb. G.P.	In suspension	3 0	Violent explosion and flame 30 feet above pit top -	
June 9 -	Blantyre -	Ell Coal -	Do. -	Collected from floor of roads underground and riddled.	1½ cwts. -	1½ lb. G.P.	In suspension	2 0	Very violent explosion and flame 50 feet above pit top -	An extensive explosion occurred in the splint coal at Blantyre Colliery in 1878 killing over 200 persons. Both Udston and Blantyre are very dusty collieries. This dust came from Messrs. Merry and Cunninghame's Colliery which marches with Blantyre.
June 23 -	Do. -	Splint -	Do. -	Collected from roads under ground and riddled.	1½ cwts. -	1½ lb. G.P.	At rest - -	15 0	No explosion, charring 7 yards	
Do. -	Do. -	Ell Coal -	Do. -	Do. -	1½ cwts. -	1½ lb. G.P.	In suspension	2 0	Violent explosion and flame 30 feet above pit top -	
June 22 -	Barrwood and Hough.	Kilsyth -	Do. -	Collected from ledges in return air roads underground.	2 cwts. -	1½ lb. G.P.	At rest - -	15 0	Most violent explosion and flame 60 feet above pit top -	An explosion occurred in this seam in 1878, killing 17 persons.
June 24 -	Do. -	Do. -	Fine and black.	Collected at a coal crusher on surface.	1½ cwts. -	1½ lb. G.P.	At rest - -	16 0	Most violent explosion and flame 60 feet above pit top -	
Do. -	Do. -	Do. -	Do. -	Do. -	1½ cwts. -	2 lb. G.P. -	In suspension	3 0	Most violent explosion and flame 50 feet above pit top - *Tamped with clay.*	
June 22 -	Bent - -	Main and splint.	Black, rather rough.	Collected from screens.	2 cwts. -	1½ lb. G.P.	At rest - -	15 0	Very violent explosion and flame 40 feet above pit top -	No explosion at Bent Colliery, but very disastrous ones at Udston and Blantyre in the same seam.
June 24 -	Do. -	Do. -	Do. -	Do. -	1½ cwts. -	1½ lb. G.P.	At rest - -	17 0	Very violent explosion and flame 40 feet above pit top -	
July 7 -	Denny or Quarter.	Bannockburn Main Coal.	Fine and black.	Do. -	1½ cwts. -	1½ lb. G.P.	In suspension	3 0	Violent explosion and flame 30 feet above pit top -	No extensive explosion recorded in this seam.
—	Do. -	Do. -	Fine, but brown.	Collected underground.	1½ cwts. -	1½ lb. G.P.	At rest - -	15 0	No explosion, slight charring -	

The phenomena presented by these experiments as they progressed, and a careful examination of the detailed results warrant the following conclusions:—

(1.) That the flame from a blowing-out gunpowder shot in the presence of dry coal dust *always* ignites more or less of such dust, and so increases the burning and charring effects of the shot. This is proved by the fact that in almost every experiment which did not result in an actual explosion of dust, there was nevertheless severe charring of the electric firing cable for several yards up the shaft, whilst without dust and with a similar charge of explosive, no such charring occurred.

(2.) That when a large flame, such as that of a blowing-out gunpowder shot, or the flame from the ignition of a small quantity of firedamp traverses an atmosphere containing a very moderate quantity of dry coal dust, the dusty atmosphere will explode with great violence, and the explosion will *continue on* and pass throughout any length of such atmosphere, its violence and force increasing as it progresses. This is proved by the fact that in nearly every case where the cannon was fired whilst there was dust suspended in the atmosphere of the shaft, a violent explosion followed, the force of which was evidently only beginning to be developed as it reached the top of the shaft and escaped, spending itself in the outside air, the flame in some cases attaining a height of 70 feet over the top of the shaft. It is true there were exceptions to this rule, as in the case of the samples received from the Forest of Dean, Somerset, South Stafford (Great Fenton and West Cannock), Moston, Lancashire, and South Wales Anthracite. The difference in the results from these dusts was I think due to some difference in the character of the coal seams in those districts. There were also partial failures with the samples from Auckland Park and Trimdon Grange (Durham), and from Talk-o'-th'-Hill, Astley and Tyldesley, and Llanerch, but in these latter cases I am satisfied that a little more perseverance with the tests and a more careful collection of the samples would have resulted in explosions.*

(3.) That coal dust from several seams in different districts, notably those from Glamorgan, Monmouth, Durham, Lancashire, Yorkshire, and Scotland, are almost as sensitive to explosion as gunpowder itself. (*See* details of experiments where violent explosions were produced with the dust at rest in the shaft.)

(4.) That coal dust is as a rule more sensitive to explosion in proportion to its high quality and freedom from impurities.

(5.) That a ready supply of oxygen such as is supplied by a brisk ventilation has the effect of making coal dust explosions more probable and more severe.

(6.) That certain "high explosives" are incapable of igniting or exploding coal dust. It will be noticed in the details of experiments that charges of Roburite, and, in two or three cases, Ammonite were fired without effect, but as soon as gunpowder was introduced, its explosion was followed by violent dust explosions. The difference in the behaviour of gunpowder as compared with the "high explosives" *was most impressive and convincing*.

Of the whole of the dusts tested, that from the Albion Colliery, Glamorgan (Aberdare or Merthyr Four-feet Seam or Upper Four-feet) excelled all others in violence and sensitiveness to explosion, and this seam in the South Wales district has the worst history of any in the kingdom, upwards of 1,600 persons having been killed in it by explosions since the year 1845. Indeed, throughout the experiments, one could not fail to be struck by the great violence and sensitiveness to explosion exhibited by the samples received from collieries with an unfortunate history as regards explosions.

It was, I think, also evident from the experiments that the higher the quality of the coal seam the more liability there is to explosions of dust, and it is singular that the collected history of explosions in mines in past years shows that nearly all sweeping disastrous explosions have happened in seams producing the highest class of coal, such as the Durham Hutton Seam, Yorkshire, Barnsley and Silkstone Seams, the Lancashire Arley Seam, and the South Wales Aberdare Four-feet and Black Veins.

With regard to precautionary measures to be taken in the face of these facts, I have again to urge the total abolition of gunpowder from coal mines and the substitution of certain "high explosives." Many of the largest firms in the country have already of their own motion taken this step.

Mines which are naturally of a dry and dusty character cannot be artificially damped so as to render gunpowder safe, but it is nevertheless imperative, in the absence of gunpowder, that every possible effort should be made, either by watering or removing, to avoid accumulations of dry dust, so that any accidental ignition of firedamp may be limited in its effects and prevented from developing into a sweeping explosion through the agency of dust.

During the last twenty years an average of twenty persons per annum, or a total of 400 lives, have been sacrificed in the *handling alone* of gunpowder cartridges, that is, through accidental ignitions by stemming, drilling out, or setting it alight by candle sparks, quite apart from the part it has played in nearly all great colliery explosions. The loss of life from explosions during the past twenty years amounts to 4,098, and it will be much below the mark to say that gunpowder is accountable for 50 per cent. of these explosions, or a total death roll of 2,449 persons.

It is deserving of consideration and experiment to test whether a coal dust explosion would be stopped in its course by a certain length of roadway being constantly kept in a wet condition. Personally, I think such a plan would not prove effective in consequence of what may be termed the pioneering cloud of dust which precedes the flame, and also in consequence of the great explosive force developed by a coal dust explosion. In three or four experiments the remnants of dust left in the shaft after an explosion proved sufficient to cause a second explosion.

Below will be found analyses of the air in the experimental shaft, and of certain samples of the dust used in the experiments; also a description of the weather on each day when the experiments were proceeding, and also some photographs of the dust explosions.

I am glad to be able to report that the experiments were completed without accident or injury to anyone.

I am, Sir,
Your obedient servant,
HENRY HALL.

The Right Hon. Joseph Chamberlain, M.P.

Royal Commission on Explosions from Coal Dust in Mines.

* In the Haydock experiments reported in 1890, the dust explosions travelled 200 yards and were evidently increasing in force and violence as they reached the top of the shaft.

The following are analyses of five samples of the experimental dusts:—

—	—	Volatile.	Coke.	Ash.
Lightmoor Colliery	Rocky seam, from underground	22·8	30·4	46·8
Clifton Hall Colliery	Trencherbone, from screens	20·8	68·4	10·8
Albion Colliery	4 feet seam, from underground	14·1	80·4	5·5
Barwood Colliery	Kilsyth seam, from underground	24·7	45·7	29·6
Beamish Colliery	Busty seam, from screens	28·3	67·3	4·4

(Signed) W. J. ORSMAN.

NOTE.—The dusts from underground roads contain a good deal of shale dust; hence the large quantity of ash.—H. H.

The following are analyses of the ventilation of the shaft taken during the progress of the experiments:—

Oxygen	20·56
Nitrogen	79·20
Carbon dioxide	0·15
Sulphur dioxide	0·09
	100·00

Nitrogen	79·3
Oxygen	20·5
Carbon dioxide	0·2
	100·0

No trace of carbon monoxide or marsh gas found.

(Signed) W. J. ORSMAN.

National Association of Colliery Managers,
Lancashire Branch.

Orrell Colliery, Wigan,
Sir, Aug. 10, 1893.

At a special meeting of the colliery managers of the above branch the following resolution was proposed by Mr. Halliwell, of Dewsbury Park Colliery, and seconded by Mr. Walls, of Hindley Field Colliery, and carried unanimously:—

"That the best thanks of the Lancashire colliery managers be tendered to Mr. Hall, Her Majesty's Inspector of Mines, for his kindness in inviting them to witness his experiments with coal dust at White Moss."

As secretary of the branch I was also instructed to say that every colliery manager who saw the experiments is now firmly convinced that it is dangerous to use gunpowder in a dry and dusty mine, and that it ought not to be allowed to be taken into such mines. They are further of opinion that no colliery manager would continue to use it if he once witnessed your experiments.

Yours respectfully,
On behalf of the colliery managers,
(Signed) P. Mehers,
Hon. Sec.

To Henry Hall, Esq.,
H.M. Inspector of Mines.

Mr. Bell, H.M. Inspector, writes:—

Hetton Hutton Seam.

"There was an explosion in this pit in 1862. Said to have been in the boiler flues. But it is a curious coincidence that a powder shot was fired at the same moment on the engine plane; the hole is to be seen to this day, and we must conclude it was a blown-out shot.

"There has been no explosion at Hetton Colliery since this date. (Lamps used throughout.)

Eppleton Main Coal.

"I have heard of an explosion at Eppleton, even before the days of Government inspection. I think it was in the Hutton seam, and either the late Mr. T. E. Forster or Mr. E. F. Boyd would be the viewer. There has been none since. Lamps used throughout.

Elemore Low Main.

"An explosion took place in a stone drift near the shaft in 1886, when 28 lives were lost. You will find a full account of this explosion in my report for that year. This pit is now standing, and we could get no dust from it. Lamps used.

Beamish. Busty. Usworth. Maudlin.

"Both in the Newcastle district.

Silksworth Colliery.

"This is a dry and dusty pit, makes a considerable amount of gas, but they have had no explosions. Lamps used.

Auckland Park, Harvey.

"This is also a dry and dusty pit, making part gas, but they have never had an explosion. Lamps used.

Brancepeth 5/4 or Jet.

"This pit is not what you would call a very dry pit; it makes no gas, and they have never had an explosion; but in April 1889 an explosion of dust took place in a large coal hopper at bank, by which three persons lost their lives. A full account of this is given in my report for that year. Candles used in whole, but lamps in brokens.

Murton Hetton.

"Very dry and dusty, but no explosions are recorded. Lamps used.

Trimdon Grange, Harvey.

"This is a dry and dusty pit; makes part gas, working long wall, using lamps, shot firing in face. Exploded in February 1882, killing 74 people. *See* my report for that year. No previous explosions. No shot firing since explosion in 1882.

Seaham Colliery, Hutton.

"Dry and very dusty. Exploded in October 1871, killing 26 persons. Again in September 1880, killing 164 persons. Both explosions occurred during the firing of a shot in stone drift near to shaft, and, curious enough, both shots fired in the same refuge hole while attempting to enlarge it."

Mr. W. N. Atkinson, H.M. Inspector, writes:—

"The following samples of coal dust were sent to Skelmersdale from North Staffordshire:—

Great Row Seam from Great Fenton Colliery.
Seven Feet Banbury from Leycett Colliery.
Cockshead from Whitfield Colliery.
Bullhurst from Talk o' th' Hill.

"With reference to the character of these seams as to explosions and loss of life, nearly all the chief explosions have occurred in the three latter, and no serious explosion in the Great Row.

"I cannot give any particulars about the small explosions, of which there have been a great number in the district, because Mr. Wynne's reports rarely state the seams where they occurred. No explosion is recorded as occurring in the Great Row seam, but it is probable there may have been some small ones. It is one of the upper seams, and has not been much worked at such depth as to be dusty.

"The 7-ft. Banbury, Cockshead (called Cockshead on the east, and 8-ft. Banbury on the west of district) and Bullhurst are amongst the lowest seams worked, and when at depth are usually both grassy and dusty. All the seams vary greatly as to gas and dust according as they are near the outcrop or at great depth.

"The following is a list of the chief explosions which have occurred in these seams during the past 20 years.

In the 7-ft. Banbury.

1876 - -	Jammage Colliery - -	5 killed.
,, - -	Silverdale Colliery - -	5 ,,
1879 - -	Leycett Colliery - -	8 ,,
1880 - -	,, ,, - -	62 ,,

In the 8-ft. Banbury or Cockshead.

1873 - -	Talk o' th' Hill Colliery -	18 killed.
1875 - -	Banker's Hill Colliery -	43 ,,
1878 - -	Apedale Colliery - -	23 ,,
,, - -	Silverdale Colliery - -	3 ,,
1881 - -	Whitfield Colliery - -	25 ,,
,, - -	Lillydale Colliery - -	8 ,,
1889 - -	Mossfield Colliery - -	64 ,,

In the Bullhurst Seam.

1874 - -	Bignall Hill Colliery - -	17 killed.
1883 - -	Leycett Colliery - -	6 ,,
1891 - -	Apedale Colliery - -	10 ,,

Mr. Martin, H.M. Inspector, writes:—

"In reply to your inquiry as to the histories of Celynen, Llanerch, Radstock, and Lightmoor Collieries in respect to explosions, &c.

"Raises about 15 to 1,800 tons a day, has been at work in the black vein about 20 years, and is one of the most fiery and dusty in my district. I might almost say, in the South Wales coalfield. The coal is a steam coal of the semi-bituminous class. It adjoins Abercarn and Risca Collieries, where in the same seam, as you know, there have been disastrous explosions. Blasting is not permitted, and discipline is strictly maintained. Celynen Colliery.

"Meadow vein was a naked light pit up to 1890 when the disastrous explosion occurred there. It gave off some little gas, but I think about the year 1869 the most serious previous explosion occurred in it when seven men lost their lives. At the time of the 1890 explosion, killing 196 persons, it was being worked entirely with naked lights. Llanerch Colliery.

"The Radstock Collieries have no gas, the seams are small and the coal, hard house coal and steam coal, and a good deal of powder is used in ripping roof. Explosions are unknown in these collieries except in connexion with explosives. About two years ago a man was burned upwards of 10 yards or so away from a shot in the floor. The man working in the stall above, and about 15 yards or so away, was slightly burned, the heat extending seven or eight yards further. I have no doubt that dust was an element in extending the flame in this case. No similar case was previously known there by any one, some of whom had 30 years' experience.

"In the Forest of Dean. Firedamp is unknown in this coalfield. The colliery has worked over 50 years. House coal; hard seams about 2 to 3½ feet; roadways made 6½ feet in main ones, and 5 to 5½ for gate roads. Powder used in ripping roof or floor. No explosion or extension of flame known." Lightmoor Colliery.

Mr. Wardell, H.M. Inspector of Mines, gives list of explosions in Yorkshire:—

Colliery.	Date.	Seam.	Killed.
Lundhill - - -	1857	Barnsley - -	189
Edmunds - -	1862	Do. - -	59
Morley Main - -	1872	Middleton Main	34
Warren Vale - -	1874	Barnsley - -	23
Swaithe - - -	1875	Do. - -	143
Aldwarke - -	1875	Do. - -	7
Stanley - - -	1879	Silkstone - -	21
Wharncliffe Carlton	1883	Barnsley - -	20
Altoft - - -	1886	Silkstone - -	22
Thornhill - -	1893	Wheatley -	139
Oaks - - -	—	Barnsley - -	300 or more.

Middleton Main same seam as silkstone.

Mr. Stokes, H.M. Inspector, writes:—

"Clay Cross Colliery, silkstone coal dust. Clay Cross Collieries, near Chesterfield, Derbyshire. The coal is both a house and gas coal, and is extensively sold in the London market.

"The mine is very dry and dusty. Thickness of seam from 5 feet to 5 feet 6 inches. It is the most highly bituminous coal in the county. Coal slack is extensively coked. Yields about 10,500 cubic feet of gas per ton. Depth from surface varies from 200 to 300 yards. An explosion of firedamp occurred in this seam at the No. 7 pit on November 7th, 1882, by which 45 persons lost their lives. Mine worked exclusively with locked safety lamps. Gas, frequently found.

ackwell
lliery.

"*Deep Hard Coal Dust.*—Blackwell Colliery, near Alfreton, Derbyshire. This is, generally speaking, a steam coal. The greater portion of the seam being sold for steam generating, blast furnace, and other manufacturing purposes. Thickness from 3 feet 6 inches to 5 feet 6 inches. Depth from surface, 230 yards. Mine dry and dusty. Mine worked with naked lights.

ackwell
lliery.

"*Low Main Coal Dust.*—This seam passes under the names of Tupton coal, Furnace coal, and Low Main coal. It is sold for both house and manufacturing purposes. Thickness varies from 3 feet 6 inches to 6 feet. Depth from surface, 290 yards. Mine worked with naked lights and a few safety lamps. Gas occasionally found.

irley
olliery.

"*Silkstone Coal.*—Birley Colliery, near Sheffield. This is the same seam as the coal at Clay Cross, previously described. It is called "Silkstone" in Yorkshire. Birley Colliery is within a few yards of the county boundary between Derbyshire and Yorkshire. The coal from this mine is extensively sold for gas making, and a large quantity is sent to the London market for house coal. Depth from surface, 290 yards. Mine very dry and dusty. An explosion of firedamp occurred in this mine on June 26th, 1876, when six persons lost their lives. Mine worked exclusively with locked safety lamps. Gas is frequently found, and occasionally outbursts of gas occur.

nnesley
olliery.

"*Top hard coal.*—Annesley colliery, near Nottingham. This seam is called "Top Hard" in Derbyshire, and Nottinghamshire, and it is the representative of the Yorkshire Barnsley bed. It is largely used for steam and iron making. A small portion of the seam (soft coal) is sold for house-coal. Depth from surface 450 yards. Seam very dry and dusty. Worked exclusively with safety-lamps. Thickness variable, from 4 ft. 6 ins. to 7 ft. 6 ins."

Mr. J. B. Atkinson, H.M. Inspector, writes :—

Idston
olliery.

"Extensive explosion in the splint coal seam killing all the men in it and extending over all the workings. 70 to 80 men killed. Year 1887, I think.

Blantyre.

"Extensive explosion in the Splint coal killing over 200 men. Year 1878, I think. Both Udston and Blantyre very dusty.

Barrwood.

Explosion causing loss of over 20 lives. Apply to Ronaldson as to this.

"Dusty, but no explosion.

Bent.

"Udston, Blantyre, and Bent are in Lanark. Barrwood is I think in Stirling."

Mr. Lewis writes :—

Albion
Colliery.

"In reply to yours of the 15th, I have pleasure in sending a short history of the Albion Merthyr Upper Four-Feet Seam of coal.

"The Albion Colliery is situated about 14 miles from Cardiff in the Taff Valley in the county of Glamorgan, and is connected by railway with the seaport towns of Cardiff, Barry, and all other shipping ports. Operations were commenced at this colliery, January 1885. The four feet seam of coal was intersected at a depth of 545 yards on February 1887. There are two shafts, each 19 feet diameter. On December 21st, 1887, 1,100 tons of coal were raised.

"Last year the output from this seam was 534,000 tons winding only from one shaft.

"This company's workings are ventilated by a Schiele fan 15 ft. 6 in. diameter, making 46 strokes per minute, fly wheel of engine 20 ft. diameter, fan driving wheel 6ft. 6 in., producing 225,000 cubic feet of air per minute with a water gauge of $2\frac{1}{10}$ ins.

"The mode of working is the Longwall system.

"This seam is considered to be one of the most fiery in the district and has to be very carefully ventilated, besides giving off a quantity of gas, it is dry and dusty and artificial watering is resorted to. It is considered to be the best steam coal vein, and has been very extensively worked in this district, and in different places alters to some extent in section, a soft clod taking the place of the smooth partings, varying in thickness from 6 to 18 ins. It was first worked at Merthyr Tydfil and proved about 4 ft. thick hence the name of the seam. It generally works very freely, obtains the best price in the market and is most liked by the colliers. No explosion of any kind has taken place at this colliery. I enclose you a list of disasters in South Wales, those marked with a cross are (from information given, but may not be authentic) supposed to be in the Four-Feet seam of coal. Nearly all the disasters in this neighbourhood have resulted in consequence of the working of this seam.

DISASTERS IN SOUTH WALES.

Date.	Name of Colliery.	No. killed.	Remarks.
1845, Aug. 2	*Crombach	26	Upper 4 feet.
1846, Jan. 14	*Risca	35	Black vein.
1848, June 21	*Victoria, Monmouth	11	"
1849, Aug. 11	*Lletty Shenkin, Aberdare	52	Upper 4 feet.
1852, May 10	*Duffryn	64	"
1853, Mar. 12	*Risca Vale	10	Black vein.
1856, July 15	*Cymmer	114	No.3 Rhondda.
1858, Feb. 25	*Lower Duffryn	18	Upper 4 feet.
1858, Oct. 13	*Duffryn	20	9 feet.
1859, Apr. 5	Chain Colliery, Neath	26	
1860, Dec. 1	*Risca	145	Black vein.
1862, Feb. 19	*Gethin, Merthyr Tydfil	47	Upper 4 feet.
1863, Oct. 17	Morfa	30	Cribbur.
1863, Dec. 24	Maesteg	14	
1865, June 16	*New Pit, Tredegar	36	6 feet.
1865, Dec. 8	*Gethin	36	Upper 4 feet.
1865, Dec. 20	*Upper Gethin	30	9 feet.
1866, June 16	*New Bedwelbty, Tredegar	25	
1867, Nov. 8	*Ferndale	178	Upper 4 feet.
1869, May 23	*Llanerch	7	Meadow vein.
1869, June 10	*Ferndale	60	Upper 4 feet.
1870, July 23	Llansamlet	19	
1871, Feb. 24	*Pentre	38	Upper 4 feet.
1871, Oct. 4	*Gelli, Aberdare	4	"
1872, Jan. 10	Oakwood, Llynvi	11	
1872, Mar. 2	*Victoria, Mon.	19	Black vein.
1872, Mar. 8	Weinfach	18	
1874, Apr. 15	Abertillery	6	
1874, July 24	Charles Pit, Llansamlet	19	
1875, Dec. 4	*Powel Duffryn, New Tredegar	22	9 feet.
1875, Dec. 5	*Llan Pentyrch	12	
1876, Dec. 18	Abertillery	20	
1877, Mar. 8	Worcester, New pit, Swansea	18	
1878, Sept. 2	*Prince of Wales, Abercarn	62	Black vein.
1879, Jan. 13	*Dinas	3	Upper 4 feet.
1879, Sept. 22	*Waunllwyd, Ebbw Vale	84	Big vein.
1880, July 16	*Risca	119	Black vein.
1880, Dec. 10	*Naval Steam Colliery	96	6 feet.
1882, Jan. 15	*Risca	4	Black vein.
1882, Feb. 11	*Coedcae } In upcast shaft	6	
1883, Feb. 1	*Coedcae } In upcast shaft	5	
1883, Aug. 21	*Getty	4	4 feet.
1884, Jan. 16	Cwmavon	10	
1884, Nov. 8	*Pochin, Tredegar	14	9 feet.
1884, Jan. 28	*Penygraig	11	6 feet.
1885.	*Naval Penygraig	14	6 feet.
1885, Dec. 24	*Mardy	81	Upper 4 feet.
1887, Feb. 18	*Ynyshir	37	"
1888, May 14	Aber Tynewydd	5	
1890, Jan. 24	Glyn Pontypool	5	
1890, Feb. 3	Llanerch Pontypool	176	Meadow vein.
1890, Mar. 8	Morfa Port Talbot	87	Cribbur "

Mr. Douglas writes :—

"The sample of coal-dust we forwarded you from this colliery was taken from the Main Engine Plane of the Maudlin Seam (known on the Tyne as the Bensham Seam). Usworth Colliery.

"It is a seam that covers an extensive area in the eastern portion of the county of Durham, and is usually from 5 to 6 feet in thickness.

"It is, in the Usworth district, a very high class gas coal, soft in its nature, and "works" exceedingly small. The districts from which it was collected are at a depth of about 240 fathoms.

"On March 2, 1885, a very disastrous explosion occurred in this seam, causing the death of 42 lives. This explosion occurred actually on the Engine Plane and was fully described by Messrs. J. B. & W. Atkinson in their Treatise on Colliery Explosions.

Those marked * within a radius of 12 miles. Black vein in Monmouthshire, supposed to be identical with 4 feet in Glamorganshire.

NOTE.—The upper 4 feet is the same seam as the Aberdare or Merthyr 4 feet. H. H.

"About the same time the great explosion in the Seaham Colliery, which is 6 or 7 miles distant, occurred in the same seam."

Mr. Hale writes :—

Lightmoor Colliery. "We forwarded to your address yesterday 1 cwt. 56 lbs. of coal dust collected from the sides of our headings, and from the rails in our underground roads in the twenty inches seam, upper series, of the Forest of Dean coal basin, as per instructions received from J. S. Martin, Esq., H.M. Inspector of Mines, Bristol.

"We can send you more, if required, but we have nothing more inflammable in our workings, as water and not dust is our difficulty."

Mr. Hood writes :—

Llwynypia Colliery. "Referring to your circular of 27th ultimo, I beg to inform you that the sample of dust sent from this colliery was from the No. 3 Rhondda seam. We have never had an explosion in this seam here, but there was one at Dinas Colliery on the 1st January 1844, when 28 men were killed, and another in the same seam at Cymmer Colliery on the 15th July 1856, when 114 men lost their lives."

Mr. Deacon writes :—

Blackwell Colliery. "In further reference to your circular of the 27th instant, the Low Main seam is a bright friable bituminous coal. The depth from the surface at the pit from which the sample was taken is 240 yards. It is the same seam as that generally known as the Tupton seam, which is worked at Clay Cross, Grassmore, &c. The deep hard seam consists of a layer of dull hards, below which is a mixture of hards and brights in streaks, which goes by the local name of "minge." This seam lies at a depth of 180 yards at the pit from which the sample was taken.

"Both of the seams vary somewhat at different localities in the district. A few miles to the south, the Low Main becomes an unworkable seam, owing to its great friability, and the deep hard improves in quality for steam purposes, gradually hardening in its character until, at a distance of 12 miles south of these pits, it becomes a seam of almost entirely dull hard coal especially suitable for steam raising purposes."

Mr. White writes :—

Walker Colliery. "I am exceedingly sorry I was unable to be at your coal dust experiments to-day at White Moss as I intended.

"The dust I sent you was from the Beaumont Seam, 186 fathoms.

	ft. in.	ft. in.
Top coal	2 0 to	2 6
Segar band	1 4 to	3 0
Bottom coal	0 8 to	1 0

"We have a good deal of gas, and work almost entirely long wall, with a fairly good ventilation, so that we are not so much troubled with it as one might expect. We had an explosion in this seam about September 1887, just before I came here, two men killed, and our neighbours at Hebburn Colliery had one in same seam about three years ago, four or five men killed.

"We are also working a seam below this, so that we are the deepest colliery in Northumberland, 202 fathoms and certainly the most fiery. I do not think there are many worse in Durham. I shall be very glad if you could let me have result of your experiments at some future time."

Mr. Rhodes writes :—

Aldwarke Colliery. "The seam from which the dust we forwarded to you was taken is known as the Parkgate Seam, and is worked by depths varying from 420 yards at the shafts to between 7,800 yards at the extreme deep of the workings.

"The seam is 5 ft. 6 ins. thick, and has a rock roof, it is not liable to sudden outbursts of gas except when the first "break," comes on, and I think this is due to gas accumulating owing to the roof "swagging" between the face and the goof in consequence of its strong character, before finally breaking.

"The seam is dusty but no shots are fired in the coal, and only water cartridges are used in stone drifting. The roadways are watered to lay the dust as far as is practicable.

"We have had no explosions in the seam, which is worked more extensively at these collieries than anywhere else in the district."

Mr. Greensmith writes :—

Moston Colliery. "With regard to your inquiry re coal dust experiments. Our big mine has been worked at this place since the year 1830. I have been here only 12 years, during this time we have had no explosion in this mine, and I have made enquiry from old hands and they know of none. The seam is worked very largely. I only know of a small neighbouring colliery where the coal is worked outside our own place, and at this place naked lights were used until about 12 months ago, and then only introduced safety lamps owing to the development of other seams.

"At a depth of two hundred yards the seam gives off no firedamp, but gives off blackdamp. As we go deeper into the measure we do find firedamp. The dust you experimented with was swept from the ledges at what we call the 780 yards level. This level is at a depth of 615 yards vertical from the service. At this depth we never find blackdamp, but do occasionally find firedamp."

Mr. Houston writes :—

"In reply to yours of the 18th instant, the seam of coal from which the dust was sent is called the Beeston Seam, the lowest thick seam in the West Yorkshire Coalfield, and has been worked a great many years round Leeds, and is not, as a rule, a fiery seam, though several explosions of gas have occurred attended with loss of life; it is a good house coal round Leeds, but as the seam extends eastward becomes more of a hard steam coal. Peckfield Colliery.

"The dust we sent you was from the seam, and swept from the timber roof and sides, and collected in three bags which were labelled, Two bags were from the screen on the surface gathered up by men's hands.

"The dust was not riddled, but sent as gathered."

Mr. Wardle writes :—

"I should like to witness the experiments, as I don't think it will be possible for you to get an explosion from our dust, as the roof and floor is so dry and of a dusty nature that this dust mixes with any coal dust to such an extent that it will put a fire out instead of aggravate it." West Cannock Colliery.

Mr. Dixon writes :—

"The dust sent from our Bent Colliery was the produce of the Ell and Main and Splint Seams. It was collected on the screens on the surface as the workings are damp. This being so, that from the Main and Splint Seams was mixed. Bent Colliery.

"In regard to explosions, none have taken place in Bent Colliery. The extensive explosions at Blantyre and Udston Collieries, which are about a couple of miles away, were in the Splint Seam, the workings in these cases were very dry and dusty. The second explosion at Blantyre was in the Ell Seam, which I think was also dusty."

Mr. Richards writes :—

"The coal dust which was sent to you on May 30th from the Lewis' Merthyr Collieries, Hafod, was collected on the in-takes of the 4 ft. Seam at both our steam coal pits. Lewis' Merthyr Colliery.

"The large number of explosions which have occurred in South Wales, most of which I believe have taken place in the 4 ft. Seam; this is owing to the fact that this particular seam has been worked very extensively in South Wales, and has to a great extent drained the other seams partly of gas, and not because that the 4 ft. Seam contains more gas than the other seams when worked under the same circumstances."

Mr. Asquith writes :—

"In reply to your letter of 1st instant, I find that the dust from our Beamish Colliery was gathered from the Busty Heapstead, above the Belts. Beamish Colliery.

"The Busty Seam has been opened out within the last six years, and a good deal of gas is driven off. No naked lights are used in the pit, and shot firing is not allowed until the pit is done drawing coals.

"An explosion occurred on 9th April 1882 at the adjoining colliery, West Stanley, and 13 lives were lost.

"About 12 months ago, at the same place, the coal dust came in contact with a gas jet on the surface, which caused an explosion."

Mr. Robinson writes :—

"In reply to your circular of the 15th instant, the samples of coal dust sent you were taken from the Harvey and Brockwell Seams at Auckland Park Colliery. Auckland Park Colliery.

"The Harvey Seam is at a depth of 110 fathoms, and the Brockwell Seam at a depth of 150 fathoms.

"Both seams make gas and are worked with safety lamps, and have been at work about 30 years, but no explosions of any kind have taken place in them."

Mr. Garvin writes :—

"We are favoured with yours of 15th instant as to the experiments about to be made with coal dust, and we thank you very much for the invitation you have given us to witness the experiments. Udston Colliery.

"The road dust we sent you was collected from the floor of our Splint Coal Seam, where a large explosion took place in May 1887, killing all the men and horses in the pit, with the exception of two men who were found almost dead within a few yards of the shaft bottom. We have never been able to account for this explosion, because the seam from the beginning till now has been exceptionally free from fire-damp, and yet the explosion extended throughout the whole area of the workings. The seam throughout was very dry and dusty, but we used nothing but locked lamps except at the downcast bottom. It is

generally believed that the dust had most to do with the disaster.

"Blasting was generally prohibited. At the time of the explosion it was only allowed in two fast places. A shot, however, must have been fired in each of these two places either at the time or some time immediately prior to the explosion. There were differences of opinion as to the exact time the shots were fired.

"Blantyre Colliery, which *marches* with the Udston Colliery, exploded in 1877, killing over 200 men.

"The explosion at Blantyre occurred in the *same seam* as that at Udston, but there they had a larger area, the explosion extending over two working pits."

Hindley Green Colliery.

Mr. Southworth writes:—

"In reply to yours of the 5th instant, the first explosion we had was on the 26th November 1868, by which 62 lives were lost; the cause was a blown-out shot. The second was on the 15th November 1871, by which six lives were lost, caused by a blown-out shot, about 11 p.m. in a main road. There were two explosions in the Arley Mine at Ince Hall, one on the 23rd March 1853 and the other on the 18th February 1854. I do not remember the number of deaths (just now).

"I think the Arley and Wigan Nine Feet (more commonly called the Wigan Six Feet) have played the most prominent parts in the explosions in the Wigan district."

DESCRIPTION of the WEATHER during the EXPERIMENTS.

Date.	Temperature.	—	Date.	Temperature.	—
				D.B. W.B.	
May 12 -	70°	Fair.	June 22 -	60°—55°	Dull but fair.
„ 13 -	80°	Fair.	„ 23 -	54°—52°	Rain nearly all the day.
„ 23 -	58°	Fair but cloudy.	„ 24 -	58°—52°	Fair but dull.
„ 27 -	60°	Sunny.	July 6 -	78°—65°	Fine and warm.
	D.B. W.B.		„ 7 -	82°—68°	Fine and warm.
June 8 -	74°—61½°	Very fine.	„ 8 -	75°—68°	Fair, warm but dull.
„ 9 -	67°—62°	Very fine.			

APPENDIX XXI.

MEMORANDUM handed in by Professor H. B. DIXON.

June 1, 1893.

IN accordance with the terms of our Commission I visited the scenes of the explosions at Apedale, Malago, and Park Slip Collieries, and beg to make the following observations on the circumstances attending the explosions as far as they concern the propagation of the flame by coal dust.

1. *Apedale.*—The explosion occurred 2nd April 1891. I visited the pit on April 8th. The intake was damp for a considerable distance. The explosion was started in a "thirling" by a blown-out shot of gelignite probably fired, according to the evidence given at the inquest, without any water in the "water-cartridge."

A *trace* of gas was possibly present, for the seam gives off a little gas at the face; but the quantity of gas present was probably far too little to be detected. The shot was fired by an open lamp. The shot was stemmed with a highly bitumenous shale. The flame from the shot and stemming swept the floor which was covered with small coal. The explosion thus initiated travelled along the *intake* for some 200 yards, and stopped where the road became damp. The flame also traversed the adjacent workings and the *return* as far as they were dusty, and no further.

Although it is possible that a trace of fire-damp was present in the immediate vicinity of the shot and in the returns, and aided in setting up the explosion, I think it in the highest degree improbable that any quantity of gas (which might at all have affected the explosion) could have been present in the air of the intake. Unless, therefore, we adopt one of the very improbable hypotheses which have been suggested, viz., that the flame really travels in cracks and crevices above the roof—or that a sudden rush of air produced by an explosion can draw gases out of the sides which ignite, and thus propagate the explosion—we are driven to conclude that the explosion was propagated along the intake by the raising and ignition of a cloud of dust.

I collected samples of coked dust from the props, and of unburnt dust from the floor. I also took specimens of the "blackberry dirt" used for stemming, which I found to inflame readily, and to give off 13 per cent. of inflammable vapour when heated to dull redness out of contact with air.

2. *Malago Vale.*—I examined the Argus and Malago pits on September 18th, 1891, 18 days after the explosion. According to the evidence adduced at the inquest, there can be little doubt but that the explosion originated at the bottom of the Argus incline owing to the ignition of a mixture of fire-damp and air by a naked light carried by a workman. Whether there was a fall of roof liberating gas, as found by the jury, or whether the gas accumulated slowly in a nearly vertical heading cannot be positively known. Gas had previously been found in the vertical coal. The mine had not been worked from Friday night until the early hours of Monday morning when the explosion occurred. It seems, therefore, probable that the gas accumulated in the vertical heading, and formed an explosive mixture with the air in the road below, where it was ignited by Burgess' head-lamp.

The interesting questions for this Commission are—how far did this gas explosion extend, and what part was played by coal-dust in the subsequent propagation of the flame? The Argus incline was exceedingly dry and dusty. The explosion traversed the lower workings, and passed right up the Argus incline a distance of more than 1,100 yards, breaking the thick wire guides in the shaft. The flame penetrated for some distance into the levels driven from the Argus incline, but in no case *traversed* any of these levels. Now if the explosive mixture of gas had been carried by the ventilation up the Argus incline, it would have traversed in turn the several levels leading from it along which the air current flowed. If the explosion, therefore, had been due to gas alone, it would have traversed the several levels. Since it did not do so, we must conclude that the explosion was propagated up the incline either by dust alone, or by dust and a quantity of gas too small by itself to make an explosive mixture with air. But it is known that no gas was observed at the time of the explosion by the examiners who were making their rounds in the higher levels (evidence of Charles Poultney); consequently the quantity of gas at the upper portion of the Argus incline must have been under two per cent. or it would have been observed. The explosion therefore appears to have been propagated by dust thrown up into an atmosphere containing such gas, if any, as could not be detected by the official examiner.

I have had the suggestion made to me by mining engineers that the flame produced by an explosion of fire-damp and air would be extended (by the expansion of the gaseous products) though considerable distances beyond the region filled with the explosive mixture. For instance, one volume of methane mixed with 10 volumes of air would evolve on combustion sufficient heat to raise the temperature of the products of combustion to nearly 2,600° C., provided no heat were lost; at this high temperature the gases would occupy a volume nine times greater than their original volume. An explosive mixture occupying one-ninth of the mine might, therefore, it is argued, *fill* the mine with flame. Actually the propagation of flame in fire-damp mixtures is not very rapid, and the extension of the flame is not considerable. Experiments on a small scale, which I have made, show that even with the most explosive mixtures, *i.e.*, those in which the loss of heat during the explosion is *least*, the total length of flame is about twice the length of the original column of explosive gases. In no case was the flame *projected* along a tube one and a half times the length of the original column. In my opinion it is not possible that the explosive mixture, set on fire by the naked light at the bottom of the Argus, could have produced a flame sufficient to fill the whole incline unless it had found fresh fuel as it advanced. I am driven to the conclusion that the dust, which was abundant and very dry, was the main

agent in carrying the flame from the starting point of the explosion to the shaft.

Radstock.—On December 2nd, 1891, I visited Ludlow's pit, Radstock, where a blown-out shot had fired the coal-dust and the flame had travelled a short distance. No fire-damp has ever been met with in this pit. The place where the shot was fired was strewn with small coal, but the path travelled by the flame was not "dusty" in the sense in which that word is ordinarily used in mines. The flame had left very slight indications of its passage; its extent was known by a workman being burnt. In this case the flame started by the shot had died out in less than 50 yards.

Park Slip, Tondú.—I visited this mine on September 12th, 1892, 17 days after the explosion. Owing to the flooding of the mine it was impossible to penetrate to the seat of the explosion, but I examined the main intake incline, which is also the road by which the coal is hauled. This haulage road is dry and dusty, the parallel return-air road is wet. The flame traversed the whole of the intake and was projected from its mouth; it did not traverse any portion of the return. From the evidence given at the inquest there can be no doubt that the explosion originated in the lowest workings, where gas was reported two hours before the explosion. Whether the explosion originated in the west or east workings of No. 8 Stage, on which point there was a difference of opinion, does not affect the question under discussion. Given an explosion of fire-damp in No. 8 Stage, how was the flame propagated through the mine? The flame did not follow the air current. It extended throughout those parts of the mine that were dusty and did not penetrate into other parts. It is impossible that the main intake could have been filled previous to the explosion with an explosive mixture of fire-damp and air, or (in its upper portion) could have even contained the 1 or 2 per cent. of fire-damp which is admitted to be dangerous in the presence of dust. If, as I believe, the flame produced by an explosion of fire-damp in No. 8 could not, by the expansion of the gases, have been projected throughout the whole incline, it follows that the flame must have been fed by fresh fuel as it passed up the incline. In my judgment the dust, which was abundant and dry, in the incline (at all events in the upper portion which I examined) was the fuel that propagated the explosion to the mouth of the pit.

The experiments of Mr. Hall's at Skelmersdale, which I have witnessed, have placed it beyond doubt that certain dusts, taken from mines, when thrown into the air and inflamed by a gunpowder shot do produce a veritable explosion of air and coal dust alone. The disturbance, once started, is sufficient to raise the dust from the surfaces on which it rests and to form an inflammable mixture of dust and air by which the flame is propagated as far as the dust extends. The quantity of dust strewn by Mr. Hall in the experimental shaft is not greater than that occurring in actual mines. His experiments show that dusts from different pits differ greatly in inflammability. They also show that a great initial disturbance is required to start a dust explosion. The experiments prove conclusively, to my mind, that an explosion, once started in a dry and dusty mine, may be propagated throughout the whole of the workings that are dusty *by the ignition of dust alone.*

H. B. DIXON.

POSTSCRIPT, March 20, 1894.

Camerton.—An explosion occurred in the New Pit at Camerton Colliery in the Radstock district on November 13th, 1893. On November 28 I made a careful inspection of the pit in company with Messrs. J. S. Martin, A. H. Stokes and W. N. Atkinson, Her Majesty's Inspectors of Mines. The extreme interest attaching to this explosion lies in the facts that fire-damp is absolutely unknown in this coal field, and that the immunity from serious explosions enjoyed by this district for the last 100 years has been one of the chief arguments against the "coal-dust theory."

The origin of the explosion was a gunpowder shot in the stone roof of a self-acting incline about 350 yards yards distant from the face, and 2,100 yards from the downcast shaft. The incline constituted the intake air-way to the face of the workings. Owing to a "joint" or "fault" three inches beyond the end of the shot hole, the charge did not do the work intended, and blew down barely a hundredweight of stone. Nearly the whole of the incline was dry and dusty, and there was as far as I could judge, more dust in the immediate neighbourhood of the shot than in the other parts of the incline. The flame was propagated both up and down the incline, but practically no damage was done for 80 yards in either direction. Forty-five yards from the shot one of the men's candles was found still standing upright in its holder uninjured, except that "the wick was drooping." Inwards the chief damage was the smashing of doors and the overturning of trams standing at the top of the incline. Outwards considerable damage was done, the effects of the violence being evident for 1,300 yards from the source of the explosion. The explosion was confined to the intake airway, dying out inwards near the damp face and outwards where the road was wet and free from dust.

In examining the mine, my attention was chiefly directed to testing for traces of fire-damp in such places as appeared most likely to contain it, if any had issued from the strata. The instrument I used was Professor Clowes' hydrogen lamp, with which I had previously had considerable practice both in laboratory experiments, and in gassy mines. I have satisfied myself that the lamp will show the presence of ¼ per cent. of fire-damp in the atmosphere. Careful tests were made at two places in the returns, at the working face, and at the spot where the shot was fired. Tests were also made in three cavities in the roof where falls had taken place, and also at the entrance to an old road which extended a few yards into the goaf near the shot. In no case was the slightest indication of gas observed in the lamp. Mr. A. H. Stokes, testing at different places with his alcohol lamp, also failed to find any traces of gas. At my request, the incline was completely sealed up by stoppings in the intake and returns, between November 29th and December 8th. Mr. Martin examined the air when the stoppings were removed, and could detect no trace of fire-damp in any place in the mine. The evidence being thus conclusive that no trace of fire-damp existed after the explosion, and the testimony of those working in the mine being unanimous that no trace had ever been met with previously, although many faults had been cut through, the only conclusion possible is that this was a dust explosion pure and simple.

Samples of dust collected at different places, were analysed by me with the following results:—

ANALYSIS OF DUSTS FROM CAMERTON COLLIERY.

The samples were dried at 212° F. before analysis. The ash left in each case was brown in colour, due to ferric oxide:—

Sample.	1.	2.	3.	4.	5.
Volatile combustible matter.	30·54	28·2	17·2	24·64	18·45
Fixed carbon - -	44·44	45·6	31·81	38·25	15·98
Ash after burning -	25·02	26·2	50·99	37·11	67·10
	100·0	100·0	100·0	100·0	100·0

No. 1. Dust from ground of roadway near explosion.

No. 2. Deposited dust from rollers near explosion (not there previously).

No. 3. Dust from sides half way in from "Pump Corner."

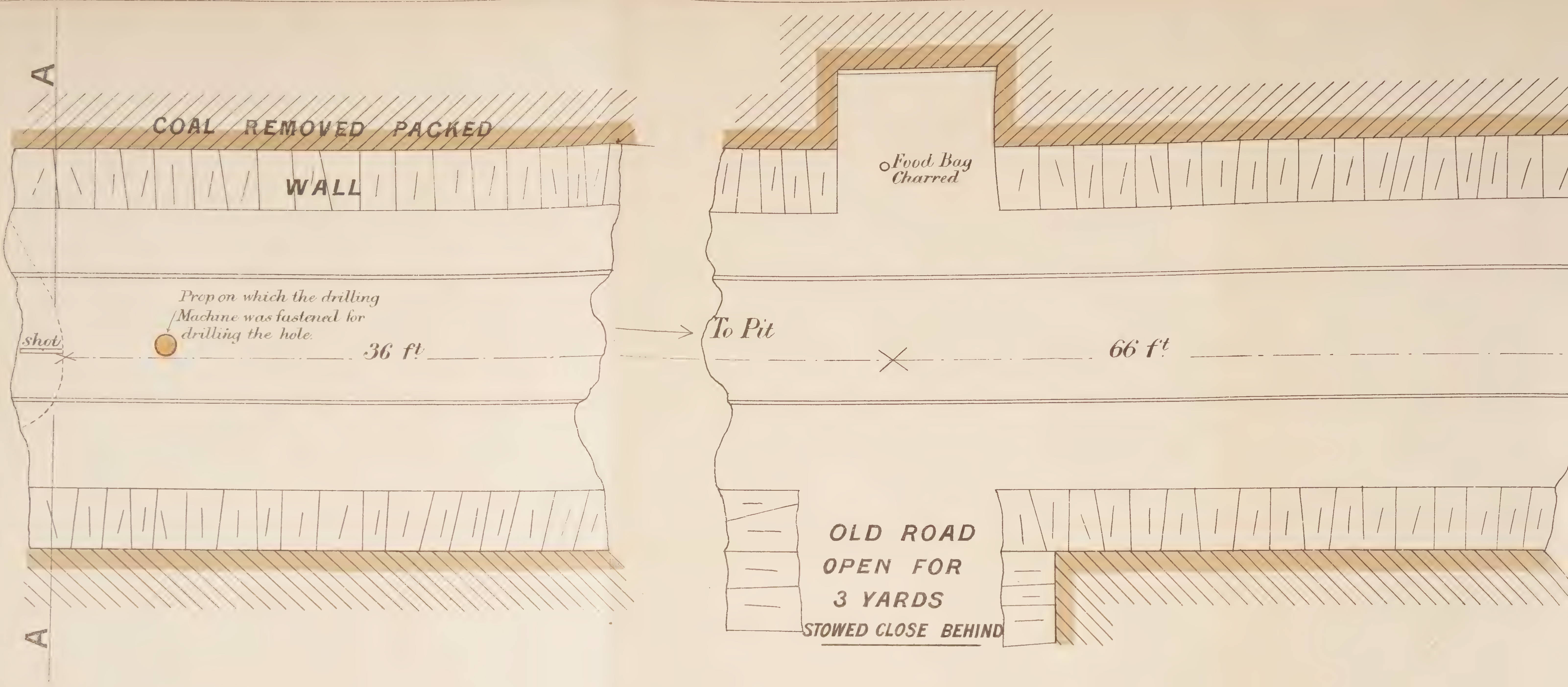
No. 4. Ordinary dust from bottom near pump corner.

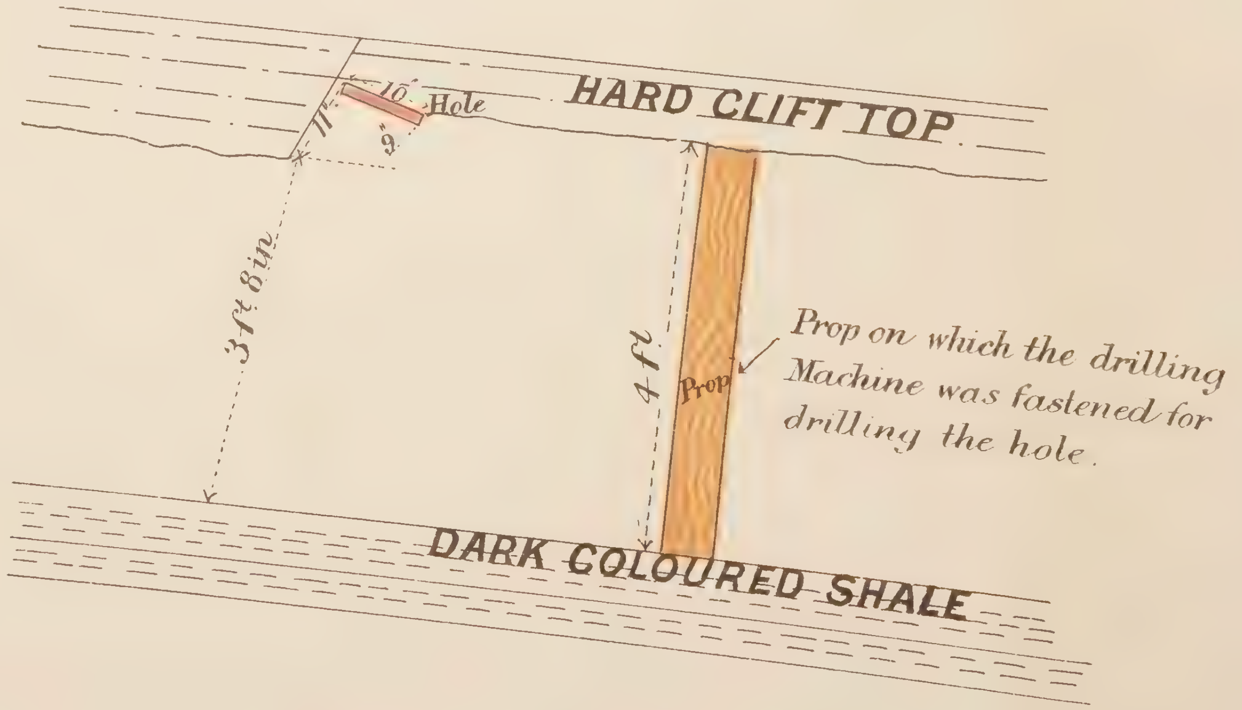
No. 5. Fine dust deposited on sides, 50 to 100 yards inside of "Pump Corner."

It is to be observed that samples 1 and 2 are closely similar; the dust raised from the floor by the explosion being only slightly burnt. The dust contains a high percentage of volatile inflammable matter. If the flame travelled outwards to within 100 yards of the "Horse Gug," and I agree with Mr. Atkinson that the dust collected at that point from the timbers, had been heated to the softening point, the explosion must have leapt over several damp places. At the bottom of the incline the road was wet, but a train of full tubs standing there, may have supplied the necessary dust; but between the pump corner and the furthest point reached by the flame were two lengths of roadway which were wet. One was about 20 yards long, and the other about 35 yards long.

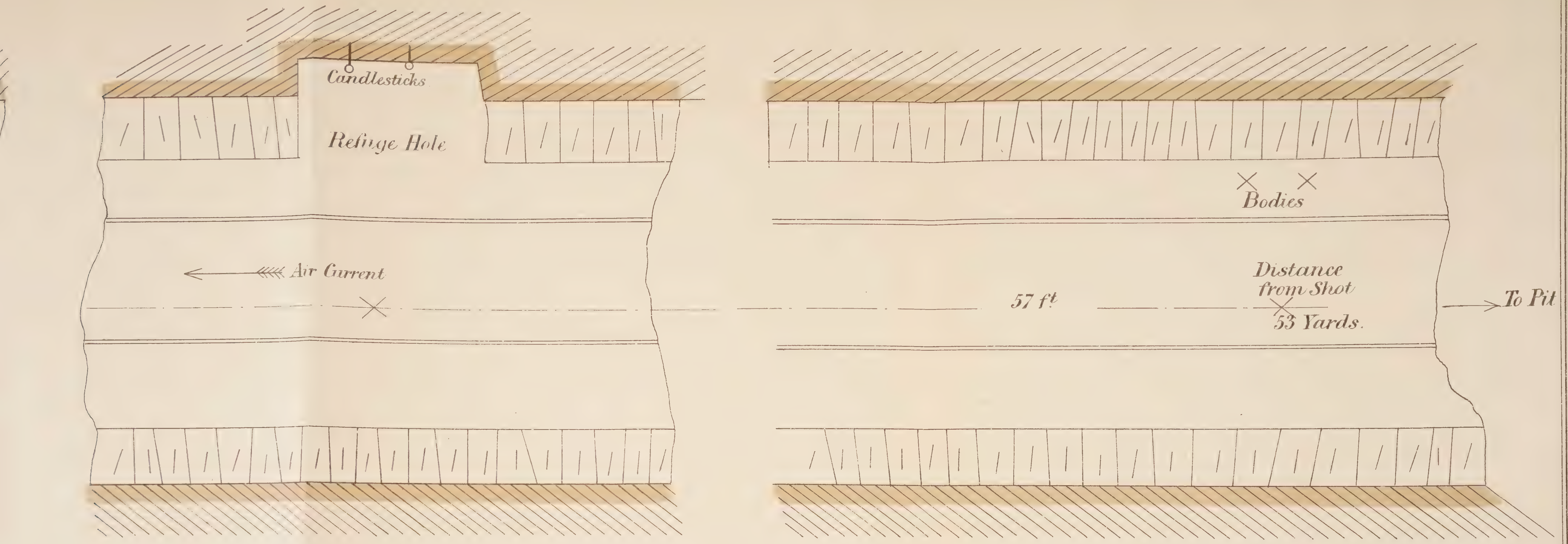
This extensive explosion of dust in a non-fiery mine, taking place under ordinary working conditions, is the *experimentum crucis* required by those who did not admit that the artificial conditions under which Mr. Hall produced his dust explosions, were such as would occur in the ordinary working of a mine. The explosion at Camerton has indeed exactly fulfilled the conditions as to circumstances and place, demanded by one of the witnesses who gave evidence against the "dust theory." No artificial experiment could have been so complete and convincing.

H. B. D.

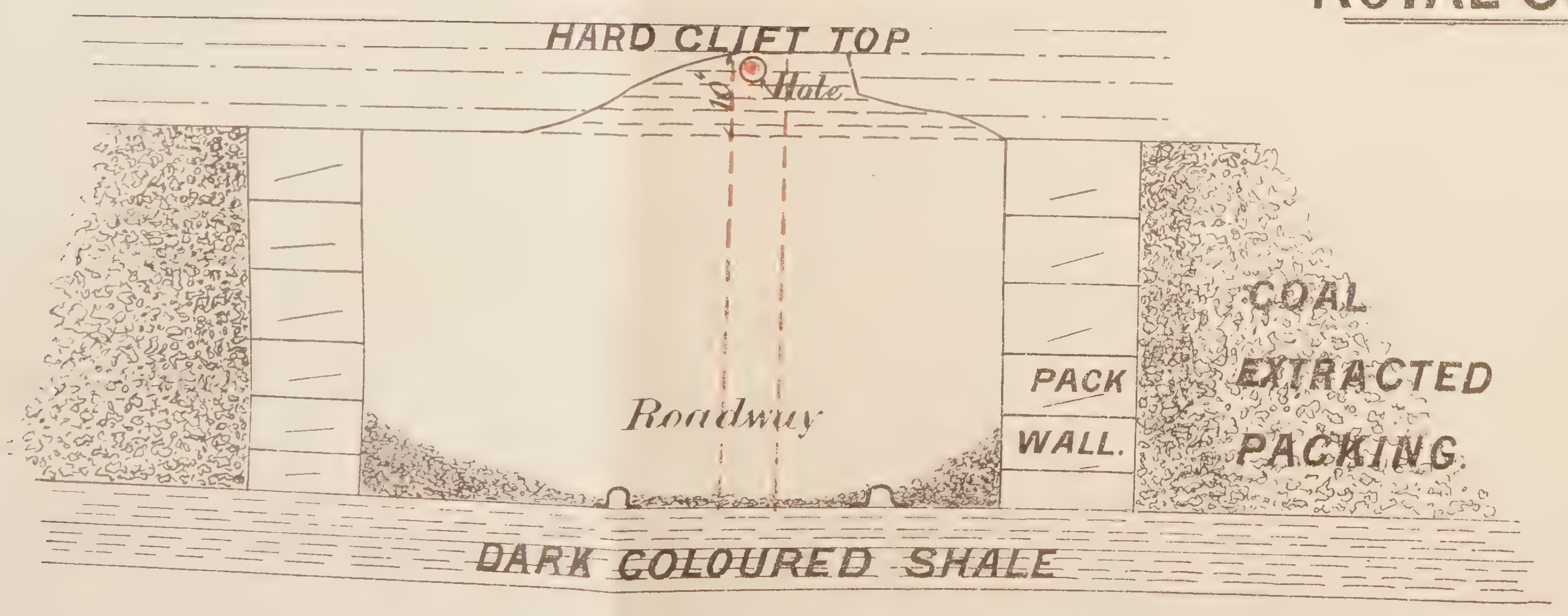




SIDE ELEVATION.



PLAN.



SECTION AT A . A.

ROYAL COMMISSION ON EXPLOSIONS FROM COAL DUST IN MINES.

Appendix XX. (b)

To illustrate evidence on Explosion in New Pit, Camerton Colliery.
(Handed in by Mr. J. S. Martin)

— *Scale ½ Inch = 1 Foot.* —

INDEX.

ABERDARE AND RHONDDA VALLEYS: *See under* SOUTH WALES.

ABERDARE AND RHONDDA VALLEYS COLLIERY OFFICIALS' ASSOCIATION:

Represented before the Commission by *Mr. John James Thomas*; 6192. This association represents an output of eight million tons annually and 45 collieries; *Thomas*, 6267, 6268. Does not think that any of the members would say that an open light, or even a torch, would ignite coal dust. Believes that they are all in accord that a blown-out shot, without any gas to commence with, may cause an explosion if fired into dust under certain conditions; 6269–75.

ALTOFTS EXPLOSION:

A dust explosion entirely; *Ashworth*, 4622; originated by a shot; 4623. The friction and heat of the explosive blowing out across the ropes, chains, rails, signal wires, &c. set up an electrical condition which disturbed the dust all along the roads; 4635, 4636, 4674–76. There was a space of from seventy to eighty yards on each side of the shot in which practically no damage was done; 4654. Believes the shot faced the air current; 4720–24.

A mine which makes a lot of gas. Thinks there must be some mistake with regard to the assertion that there was no gas present; *H. W. Martin*, 5529–5534.

AMMONITE:

Has used it for two or three years with gratifying results; as strong as any of the high explosives; no complaints about its showing flame or emitting fumes; *Wilkinson*, 5561, 5604. Uses no water cartridge with it; 5583. Considers it perfectly flameless according to his experience with it and the experiments he has made with it; 5585. Has had several blown-out shots with it; does not use it in the actual coal getting, but only in the roof; 5586–90. It is used in several places in the North of England, in Staffordshire, and in a number of places in South Wales; 5612. Might get a flame if no tamping were used; 5613–15. There is not much difference between the cost of working with ammonite and gunpowder; 5616–22.

Has tested it by means of experiments and finds it has very little flash; the flame is not strong enough, or continuous enough, to ignite dust; *Thomas*, 6230–36.

APEDALE EXPLOSION:

The friction and heat of the explosive blowing out across the ropes, chains, rails, signal wires, &c. set up, in witness's opinion, an electrical condition which raised the dust all along the roads; *Ashworth*, 4635, 4636, 4766. Description of the shot; 4648. A cartridge used without water; 4685, 4701, 4702. Gelignite, or gelatine dynamite, used in the same sized hole as they bore for powder; 4697–99. Caused by a shot at the working face; position of the shot; 4760–66. Witness has not visited the pit and only knows the circumstances from reports; 4775, 4776. Position of the rails and pipes; 4777–84.

See Professor Dixon's Report, Appendix XXI.

ARDEER POWDER:

Has tested it by means of experiments and finds that it gives very little flash; the flame not strong enough, and continuous enough, to ignite coal dust; *Thomas*, 6230–36. Its composition; 6252.

ASHTON MOSS COLLIERY EXPLOSION:

Caused by a blown-out shot; *Ashworth*, 4617. The dust was not ignited; 4618. Dust off the floor used as stemming; 4750.

ASHWORTH, JAMES:

Mining engineer at Morley in Derbyshire; 4597.
Attention first called to coal dust by explosions beginning in the year 1875; 4600.
Examined the mine after the explosion at Swaithe Main, at Barnsley, in 1875; 4601–08.
Describes an explosion at the Sheriff Pit, Silverdale, in 1878; 4609–16.
Investigated explosions at Ashton Moss Colliery and at Sladderhill, Staffordshire; and at Wood Pit at Haydock; 4617–21, 4775–84.
Thinks the part played by coal dust in explosions important enough to justify special attention; 4622.
Hands in a table showing the effect upon the atmosphere of an explosion of gunpowder; 4625. Appendix XIV.
Advocates the use of powder of the best quality in place of the common powder; 4626, 4678–85, 4687, 4744, 4745.
Difficult to get a blown-out shot with such a powder; 4627–29, 4746–48.
Is of opinion that every explosive should be used in a hole of reduced diameter in proportion as it is stronger than gunpowder; 4630–33, 4645, 4695–4704.
Important that explosives should not be used in any case where there are ropes, chains, rails, or signal-wires in the line of fire; 4634–37, 4667–76.
Describes experiments with various lamps; 4638–41, 4704–12, 4733–43, 4767–74.
Necessary with every safety lamp, if the mine is dry and dusty and gives out firedamp, unless the gauze is specially protected, that that lamp should have two gauzes; 4642.
Watering of no value whatever, as it is impossible to properly saturate the dust; but an explosion may be arrested by having wet patches on the roads; 4643, 4644, 4713–19.
No shot should face a strong current of air. This applies principally to the main roadways and not to the working-faces; 4646, 4720–24, 4759, 4765–66.
Shots should be fired by electricity not by an ordinary fuse; 4647, 4725.
The question of leverage, that is, the length of the charge, most important; 4648, 4690–94, 4751–4756, 4784–86.
In the present state of knowledge all the so-called flameless explosives should be protected; 4649, 4650, 4686.
In any experiments it is necessary to have an atmospheric velocity of from 30 to 50 feet per second, with a water gauge of not less than 2½ inches, and ropes and chains should be provided; 4651, 4652.
Suggests a syphon-shaped tube made in wrought-iron box girder form about 30 inches square, and not less than 150 yards long in a straight line; 4654; 4655, 4656, 4663–65, 4728–32.
Thinks experiments should be made with various kinds of powder and other explosives; 4657, 4658.
The fireman, or deputy, should examine a hole before it is charged, and should superintend the charging; 4659–62, 4726, 4727, 4749, 4750, 4757, 4758.
Explains that three explosions follow a blown-out shot, and that unconsumed particles of gunpowder are thrown out and explode when they get mixed up with sufficient air; 4654, 4678, 4787–4809.

ATMOSPHERE:

Changes in the atmosphere caused by a blown-out shot of gunpowder; *Ashworth*, 4625, 4792–4802. Appendix XIV.

AUSTRIAN COMMISSION:

Extract from Report relating to Coal Dust. Appendix XIII.

BEDLINGTON, RICHARD:

President of the South Wales Institute of Engineers; engaged for fifty years in mining in Monmouthshire and Glamorganshire; 5658–62.

During the whole of his experience does not know of a single explosion in South Wales that has not been caused by gas; 5663, 5664, 5682, 5711–15.

Considers that dust has played a part in the extension of explosions; 5665.

Does not think that coal dust produces an explosion in itself, but believes that it aggravates an explosion of gas; not, however, by flame so much as by coked dust, which scorches. Will extend the effects of an explosion to a limited extent; 5666–71, 5683–94

Does not consider the regulations of the Mines Act with regard to dust really necessary. According to his experience there has not been any case brought home in which even a blown-out shot has caused an explosion of the dust. Such a case is just possible, but there is no practical danger; 5672–74, 5707–10.

Thinks it desirable to clear away the dust as a sanitary matter, but not to prevent danger; 5675, 5676, 5695.

Does not believe it necessary to take any precautions with explosives except so far as gas is concerned; 5677–83.

In the mines under his charge the dust is removed. Does not water as it softens the strata; 5696–5704, 5749.

Uses powder, compressed powder, gelatine and dynamite; 5705, 5706.

Insists that any experiments should be made with dust from a seam of coal that has never been known to give off gas; 5715–29.

Describes a blown-out shot in coal-dust; 5730–37.

Does not think the flame of an explosion will continue as far as dust extends; 5738–42.

Has examined mines after an explosion, but has never seen indications that the flame had passed over a certain portion of the mine, and, after an intervening space, had resumed its course; 5742–45.

The mines of which he has had experience are dry and dusty; 5746–48.

BELLITE:

No practical experience of it; *Ashworth*, 4686.

Has seen tests with it, but noticed no flame; *Morgan*, 4828. Nothing near as effective as powder in bringing down the rock and hard ground which they have in South Wales; 4834, 4835, 4846.

Has tested it by means of experiments, and finds that it has very little flash; the flame is not strong enough, and continuous enough, to ignite the dust; *Thomas*, 6230–36.

BLASTING:

All the high explosives depend for their safety on the strength of the detonator; *Ashworth*, 4629. Suggestions with regard to the size of the charge hole; every explosive should be used in a hole of reduced diameter in proportion as it is stronger than gunpowder; 4630–33. This is not the invariable practice; 4695, 4696, 4700, 4703. Explosives should not be used in any case where there are ropes, chains, rails, or signal wires, anywhere in the line of fire, as the heat of the explosive blowing out across them sets up an electrical condition which disturbs the dust all along the roads: Altofts, Elemore, and Apedale Explosions referred to as cases in point; 4634–36. The diameter of the bore hole should be properly regulated; 4645. In dry and dusty mines ordinary black powder should not be used, but only powder of the very best quality: every shot should be detonated; 4645. No shot should face the current: this applies only where there is a very strong current—in the main roadways principally, not at the working faces; 4646, 4720, 4759, 4765. All shots should be fired by an electric fuse; 4647. The question of the leverage of the shot most important; 4648. If regulations were made with regard to stemming, is of opinion that they could be effectually enforced; 4659–61. The fireman, or deputy, should examine the hole before it was charged, and should superintend the charging; 4662, 4726, 4727. Leverage the great test point; 4691–94. Does not say that fuse firing is altogether unsafe, but considers electric firing the safer of the two; 4725. Thinks the provisions of the Act of 1887 which forbids the use of small coal for stemming is generally observed. In the explosion at Ashton Moss in 1891 the dust from the floor was used as stemming; 4749, 4750. Desirable to leave a little of the coal that was holed on, rather than to run any risk by shutting it all off; 4751. Slines or partings in the coal; 4752–56. Marly floor dirt when damp a good stemming; 4757. In any amendment of the Mines Act it should be made compulsory for the fireman to examine the hole and to superintend the charge before firing; 4758. Witness explains that by the term "leverage" he means the length of the charge; 4784–4786.

The practice adopted in South Wales: *Morgan*, 4874–4876. The fireman does not examine the hole or the strength of the charge; 4877–4879. If there were such supervision it would reduce the number of accidents, but the number of men required would make the cost too great; 4880–4883. The better remedy would be to give the men some specific instruction in shot firing instead of leaving them to gain their experience in a haphazard manner; 4884–89. If carried out, the law with regard to shot-firing is sufficient as it is; 4860, 4861.

Seaham explosion caused by an ordinary shot in the stone—not a blown-out shot; *Forman*, 5056–58.

Shot firing ought to be abolished in coal mines, no matter what kind of explosive is used—whether gunpowder, roburite, tonite, dynamite, or any of the other patent explosives—there will always be a danger of explosions in coal mines which give off a large quantity of gas; *Woods*, 5203. *See also* Mr. Woods' evidence under "Precautions." In 1887, the miners generally, with the exception of the South Wales district, were in favour of the prohibition of shot firing; *Woods*, 5204–15.

Blasting at Dowlais Iron Company's collieries *See* under "DOWLAIS."

A most serious thing if explosives were done away in the South Wales mines; *Martin*, 5445.

Precautions taken in the Forest of Dean; *Brain*, 5813, 5814. Has invented an electrical fuse to supplant the time fuse. With it there is no tendency to miss fire; it dispenses with the use of a lamp to fire the fuse and avoids the danger of exploding any gas that may be present; 5819–25.

Blasting at Camerton Colliery; *Garthwaite*, 6310–6317, 6417. *Brown*, 6522–25, 6561–66.

Should be done by electricity instead of by a fuse; *J. S. Martin*, 6607, 6656.

See also under "BLOWN-OUT SHOTS," "EXPLOSIVES," "GUNPOWDER," "PRECAUTIONS," "WATER CARTRIDGE," "ROBURITE," "SECURITE," "TONITE," "BELLITE," "ARDEER POWDER," and "AMMONITE."

BLOWN-OUT SHOTS:

Case of a blown-out shot at Sheriff Pit, Silverdale, in 1878; *Ashworth*, 4609. Thinks the dust that was in the air carried the flame to some extent, but the dust did not explode, and there was not much gas; 4610. The flame burnt and killed a miner about 60 yards distant from the shot, thinks the dust carried the flame; 4611. Did not notice any wet place; 4613. Generally speaking, in every big disaster which has occurred from a blown-out shot, the shot has faced the current; 4720. Refers to the explosion at Ashton Moss Colliery which was caused by a blown-out shot; 4617. The dust was not ignited; 4618. States that when there is a blown-out shot, particles of unconsumed powder are blown out from the shot-hole, and, when mixed with sufficient air, burst into a second explosion; 4654, 4787, 4788, 4803–4806. Not a common case for unconsumed powder to be blown out: the shot would have to be largely over-powdered; 4807–4809.

From personal observation believes that in the majority of cases blown-out shots do not give off flame; *Morgan*, 4817, 4849–52, 4855, 4890–96.

His experience is that there is generally a flame with blown-out shots; *Isaac*, 4956, 4966. Blown-out shots are caused by undercharging as a rule; also to insufficient tamping and to inexperience; 4959–4965, 5028–5034. Describes a case in which a blown-out shot exploded gas; 4967–75.

Refers to experiments at Dowlais by Mr. Galloway in which blown-out shots ignited the dust; *Martin*, 5479–82.

Risca explosion caused by a blown-out shot in dust; *Wilkinson*, 5539.

BLOWN-OUT SHOTS—*continued.*

Has seen a blown-out shot in a dry and dusty place; *Bedlington*, 5730–37.
See the two cases of blown-out shots described by *Mr. Brain* and *Mr. McMurtrie*, under "RADSTOCK DISTRICT."
Has seen a blown-out powder shot under ground; would say the flame extended 5 or 6 feet, in a place which is damp naturally: *Hood*, 6024–27.

BRAIN, FRANK:

Member of the Institute of Civil Engineers; member of the South Wales Institute of Mining Engineers; on the executive council of the National Association of Colliery Managers; manager of the Trafalgar Colliery in the Forest of Dean; associated with the working of the Forest of Dean Collieries for the past twenty years; 5750–56.
Of the opinion that it is decidedly impossible for dust to initiate an explosion; 5757–59.
Explosive gas has never been found in the Forest of Dean, and the Collieries of this district have been quite free from explosions; 5760, 5761, 5863.
Has made extensive inquiries, and believes that an explosion caused by dust has never occurred in the Forest of Dean; 5762.
Some of the Dean Forest mines are dusty, and shot firing with gunpowder is largely practised; 5763, 5764.
Has never known a blown-out shot in these collieries to be followed by any kind of explosion; 5765, 5766.
Refers to the explosion at Ludlow's Colliery, at Radstock, which was caused by a blown out shot; 5767–71. Would hardly call it an explosion, but looks upon it as a prolongation of the flame of the blown out shot, and, taking that view of it, thinks it strongly confirmatory of his opinion that coal dust, as found there, would not cause an explosion; 5772, 5773, 5800, 5835–83. Abundance of coal dust at the point where the explosion, or inflammation ceased; and no dampness whatever; 5778. Refers to the quality of the dust; and fails to see, if the coal dust was sufficient to carry the flame thirty or forty yards, why it should not carry the flame 100 or 150 yards; 5779–94.
Believes that it is not possible for coal dust to carry on an explosion to any great length; it may add fuel to the fire, but it dies out in a short distance; 5774.
Reads resolutions passed by the managers of the Somersetshire, Bristol, and Dean Forest Collieries, which affirm that dust in the non-fiery seams of these districts will not *per se* cause an explosion, and has never been known to explode; and also contain suggestions with regard to experiments; 5795–99, 5919–22. These resolutions do not hold good with regard to the fiery seams in the districts named; 5904–909.
Thinks the general rules of the present Act with regard to watering and shot-firing are sufficient; 5801–804.
So far as the Forest of Dean is concerned, does not think that these regulations are necessary; 5805–12.
Does not use flameless explosives, and would certainly not prohibit gunpowder in the Forest of Dean; 5813–18.
Has made a study of blasting with a view to supplant the time fuse by an electric fuse, and the system has been very largely adopted in many parts of the country; 5819–25.
Refers to the Report of the Prussian Commission with regard to the distance to which the flame from coal-dust, or an explosion of coal-dust, might be continued; 5825–34.
Does not give any opinion upon matters in general: confines himself to his own district; 5883–88.
Does not find it necessary to put into force the provisions of the Mines Act with regard to dust; 5889–91.
Does not think it dangerous in the Forest of Dean Collieries to fire more than one shot at a time; 5892–94.
Draws a distinction between the explosion, and the mere inflammation, of coal dust; 5895–5903.
In reference to experiments suggests that a chamber on the surface should be built four hundred or five hundred yards long and about six by seven feet wide; 5910–22.

BRANCEPETH—THE EXPLOSION IN A HOPPER:

Thinks that this explosion was due to gas given off by the coal dust; *Thomas*, 6206–209, 6253, 6254. If tested with a safety lamp under the same circumstances thinks it would be found that gas was present; 6287, 6288.

BROWN, JOHN:

Examiner and Fireman, Camerton Colliery, near Radstock; 6492, 6547–54. Describes the condition of the New Pit as regards ventilation, gas and dust; 6497–504, 6522–32, 6561–68.
The position of the shot, the amount of charge, and the quantity of dust in the neighbourhood; 6505–21, 6537–46, 6555–60.

BRYNN HALL COLLIERY EXPLOSION:

Particularly well ventilated: difficult to detect the gas in the nine feet seam; *Woods*, 5257.

CAMERTON COLLIERY:

Explosion in New Pit, 13th November 1893; two lives lost; *Garthwaite*, 6321, 6324–26.
Description of the seams worked; *Garthwaite*, 6298–6302.
The colliery has been worked for upwards of a hundred years without any trace of gas, and witnesses are convinced that it played no part in the explosion; *Garthwaite*, 6303–306, 6349; *J. S. Martin*, 6581–83, 6627, 6628.
No precautions whatever have been taken against gas or dust; *Garthwaite*, 6307–9, 6385–88, 6427–30; *Brown*, 6497, 6498, 6502–504; *J. S. Martin*, 6661.
The mode of blasting, and the number of shots fired; *Garthwaite*, 6310–17; *Brown*, 6522–25, 6561–66; *J. S. Martin*. 6629–33.
Does not consider the New Pit dusty; *Garthwaite* 6318–19, 6421–24, 6458.
Description of the place at which the explosion was initiated, the position of the shot, and the amount of charge; *Garthwaite*, 6321–22, 6336–93, 6419, 6425, 6426, 6431–40, 6447–52, 6458, 6463–65; *Brown*, 6499–501, 6505–21, 6537–46, 6555–60; *J. S. Martin*, 6617–22, 6671–83.
Two shots were fired; *Garthwaite*, 6323, 6328–33; *J. S. Martin*, 6657–59.
The indications of the second shot; *Garthwaite*, 6327, 6335.
Dust was in the air when the second shot was fired; *Garthwaite*, 6334.
The position of the bodies; *Garthwaite*, 6338–40.
Charring of timbers, coked dust, &c.; *Garthwaite*, 6341, 6342; *J. S. Martin*, 6701.
The course of the explosion, the description of the roads as regards dust, &c.; *Garthwaite*, 6343, 6344, 6401–404, 6468–79; *J. S. Martin*, 6587–94, 6641, 6642, 6687–6700.
There were little indications of violence for some distance on both sides of the shot; *Garthwaite*, 6345, 6400, 6416, 6417; *Brown*, 6533–36.
The explosion terminated at a damp spot; *Garthwaite*, 6346; *J. S. Martin*, 6592.
The explosion was initiated by the firing of an overcharged, or partly blown-out shot, and carried on by coal dust without the presence of firedamp; *Garthwaite*, 6348, 6371, 6372, 6391, 6392, 6415; *J. S. Martin*, 6580, 6581, 6595, 6596, 6599.
Reasons for the non-occurrence of similar explosions in past years; *Garthwaite*, 6350–52, 6414, 6441, 6442.
The explosion died away as it approached the working faces where the dust is damp and mixed with shale; *Garthwaite*, 6368–370; *Brown*, 6526, 6527, 6567, 6568.
Gas has never been found in the faults, nor in the goaves, nor has come off in the case of falls; *Garthwaite*, 6373–84, 6405–13, 6430, 6445, 6446, 6453–6457, 6480–85; *J. S. Martin*, 6627.
Reasons why the first shot did not cause an explosion while the second one did; *Garthwaite* 6395–99; *J. S. Martin*, 6612–16, 6623–27, 6684–86.
Open-end trams used; *Garthwaite*, 6459–62.
No trace of gas discovered after the explosion; *Garthwaite*, 6486–88; *Brown*, 6528–32, 6547–54; *J. S. Martin*, 6584–86, 6598, 6704–14; *Dixon*, 6723–31, 6736–38.
Position of the stoppings put in after the explosion; *Garthwaite*, 6489–91; *J. S. Martin*, 6702, 6703.
See Professor Dixon's report, Appendix XXI.

CLIFTON HALL EXPLOSION:

Gas brought down by fall of roof; *Woods*, 5258.

CLOWES' HYDROGEN LAMP:

Detects one quarter per cent. of firedamp; *Dixon*, 6724–26, 6729.

COAL DUST:

The part played by coal dust in explosions important enough to justify special attention; *Ashworth*, 4622.

A danger to be guarded against; *Isaac*, 4942, 4958. The dust in the travelling roads finer than that at the working faces, and more dangerous; 4998–5009. Plays an important part in explosions; *Forman*, 5037.

Believes that it always gives off a little gas, but more when it is fresh; *Thomas*, 6276.

COAL DUST AND NAKED LIGHTS:

Does "not believe that the coal dust in Wales is so "'sharp' that it would ignite at once, by the light of a candle as it were"; *Morgan*, 4818. Does not agree with Mr. Galloway on this point, and thinks he is going to extremes; 4925, 4926. Thinks the miners in South Wales generally agree with witness's opinion in this respect; 4927.

Has noticed the dust igniting in the gauze of his lamp; *Isaac*, 5021–23.

Does not believe that a naked light has sufficient flame to ignite or explode coal dust; *Hood*, 5928. Coal dust will ignite at a torch but the dust must be so thick that it would be impossible to live in such an atmosphere; 6034.

From his observation of dust about the tips, where there are fires and large comet lamps, believes that coal dust alone will not explode at a naked light; *Thomas*, 6204, 6205, 6255, 6256, 6291. Believes that the explosion in the hopper at Brancepeth was caused by gas given off by the dust; 6206-9, 6253, 6254. Has seen dust in the roads so thick that it was almost suffocating; yet under such conditions believes there is no danger with a naked light so far as dust is concerned; 6210, 6211. Dust raised at the working faces by falls of roof fails to explode at a naked light; 6212–4; 6219, 6220. From practical experience is convinced that coal dust will not explode at a lamp; it burns and inflames, but does not explode; 6221–3. A large light, such as a torch light, would not ignite the dust without the presence of gas; 6257–66.

COAL DUST AS THE MEANS OF INITIATING AN EXPLOSION, WITH THE FLAME FROM A SHOT AS THE EXCITING CAUSE, AND IN THE ENTIRE ABSENCE OF GAS:

Witness explains how unconsumed powder is ejected from a blown-out shot and bursts into a second explosion when it becomes mixed with the atmosphere; how the friction and the heat of the explosive blowing out across ropes, chains, pipes, and signal wires set up an electrical condition which disturbs the dust all along the roads and spreads the flame throughout the mine instantaneously; *Ashworth*, 4635, 4654, 4667–71. Electrical conditions caused by the rubbing of the chains, &c.; witness does not know how it happens, "but a sort "of electrical wind takes place, and throws the "dust off the various points all along the roads"; 4672. In the Altofts explosion does not think the blown-out shot was able to raise sufficient dust to cause the explosion, which he attributes in part to the presence of chains and other iron work; 4674–76. Three explosions follow a blown-out shot; 4793–97.

Does not believe that a blown-out shot will, in the absence of gas, ignite the dust and cause a terrific explosion; *Morgan*, 4817, 4855, 4856.

Believes that coal dust will cause an explosion in itself when the air is very hot in fiery mines; *Isaac*, 4939, 4940. A blown-out shot might cause an explosion in a dusty mine; 4957. Cannot say that he has had a blown-out shot which has ignited the dust; 4967. When the air is allowed to travel over a large area it becomes very hot and polluted, and when coal dust is mixed with it, believes it will explode, even when there is no gas which could be detected with a safety-lamp; 4944.

COAL DUST—*continued.*

A blown-out shot, or an ordinary strong shot, if it is overcharged, will cause the dust to ignite; *Forman*, 5038–44, 5119–21, 5137. Explains that after ignition the temperature of the dust rises until it explodes; 5045–48. The quantity of dust in the air in the ordinary working of a pit is not sufficient to explode, but it must be raised by a shot, and there must be a large quantity of fine dust adhering to the sides, timbers, and floor; 5049, 5050, 5121, 5149.

Believes that coal dust cannot initiate an explosion; *Woods*, 5185. Has worked in the most dusty mines imaginable where gunpowder was used *ad libitum*, yet never saw the slightest trace or danger of an explosion arising from dust; 5186–88. Describes an accident with a shot at a working face; 5194. From the large flame that was given off on this occasion concludes that if a blown-out shot can ignite dust it would have done so in this instance; 5263–92.

Coal dust as we see it in the general working of collieries will not cause an explosion in the absence of gas; *H. W. Martin*, 5350, 5476, 5501. Has never known a case in which dust has been ignited by a blown-out shot and without gas; 5482–84. Thinks it impossible; 5485–88.

Risca explosion caused by a blown-out shot in dust; *Wilkinson*, 5539. *See also under* "RISCA EXPLOSION." Coal dust a very serious danger, and may be the cause of an explosion even without gas; 5549, 5550.

Will not in itself cause an explosion; *Bedlington*, 5666. According to his experience there has never been a case brought home in which a blown-out shot has caused an explosion in dust; 5673, 5684, 5707–10. Of itself not a serious danger; 5693, 5694.

Is decidedly of the opinion that coal dust will not initiate an explosion without the presence of gas; *Brain*, 5759. *See* Mr. Brain's evidence under "RADSTOCK DISTRICT."

Coal dust is inflammable without the presence of gas other than that contained in itself; *Hood*, 5925. To set up the inflammation an explosion is not necessary, but it will explode or inflame by simple contact with the heat; 5926, 5927. Describes how coal dust ignites or explodes at a coke oven: the flames reach a distance from the oven of from six to eight feet; 5929, 5997–6001. There must be a considerable body of heat to ignite the dust: a blown-out shot of gunpowder would be sufficient without the presence of gas; 5930–33. *See also* under "PEN-Y-GRAIG" and the "NATIONAL COLLIERY EXPLOSIONS."

Believes that ordinary shot firing will not cause either a lengthened flame or an explosion in a coal mine: speaks more particularly with regard to his own experience and the class of dust in the mines that he has to deal with; would rather not express an opinion upon such dust as is found in the Rhondda Valley; *McMurtrie*; 6146–6150. "Where the flame "from a blown-out shot is in immediate contact "with the dust it will no doubt cause combustion, "and that may extend to other coal dust, and so it "may be extended along the face; but the effect "rapidly decreases, and at the end of 30 yards "practically dies out"; 6177. See *Mr. McMurtrie's* evidence under "RADSTOCK DISTRICT."

Dust which would not be dangerous with an ordinary naked light might be very dangerous in the presence of a blown-out shot from gunpowder or a low explosive, or in the presence of an explosion from firedamp; *Thomas*, 6216–18, 6237, 6290.

Since the explosion in the New Pit, Camerton Colliery, is of the opinion that coal dust *per se* may cause an explosion; *Garthwaite*, 6348–71, 6372.

Has been convinced by the explosions in Ludlow's Pit, Radstock, and in the New Pit, Camerton, that coal dust *per se* may cause an explosion; *J. S. Martin*, 6572–82, 6600.

COAL DUST AS THE MEANS OF RENDERING FIRE-DAMP MORE DANGEROUS, AND OF INTENSIFYING AN EXPLOSION OF FIRE-DAMP:

Describes an explosion at Swaithe Main, at Barnsley, caused by a mixture of gas and suspended coal dust passing through the gauze of a Stephenson's safety lamp; *Ashworth*, 4601–608. Experiments

COAL DUST—*continued.*

with lamps show that a lamp in an atmosphere containing 4½ per cent. of gas will fail in 20 seconds if anything should disturb the dust; 4640.

Does not believe that coal dust causes explosions, but, when a gas explosion takes place, the dust is raised and kindled by the flames; *Morgan*, 4816. If an explosion of gas takes place it most decidedly could be carried on to greater distances, with the aid of coal dust, than it would otherwise go; 4819. Therefore, the presence of coal dust is a source of danger; 4820. Where coal dust is present the explosion is likely to be more fatal than it would otherwise be, especially when the place is extremely hot. The smaller the dust the more effective it is; 4821. A blown-out shot would be attended with considerable danger where there is dust and a small quantity of gas, but the place must be hot; 4853.

When the air is allowed to travel over a large area it becomes very hot and polluted, and when coal dust is mixed with it, witness believes that it will explode even when there is no gas which could be detected with a safety lamp; *Isaac*, 4939, 4940, 4944.

Where there is a small quantity of gas the presence of coal dust very much stimulates and increases the power and danger of an explosion; *Forman*, 5137.

Coal dust may increase and intensify an explosion of fire-damp; *Woods*, 5184.

Coal dust aggravates explosions initiated by fire-damp; *Martin*, 5347. It will increase the danger of such an explosion and extend it; 5348. It renders gas more liable to explode; 5349. Refers to the explosion at the Pochin Pit, Tredegar, and believes it was initiated by gas alone and aggravated and extended by dust; 5362–65.

According to the gas there will be an amount of flame, and the flame licks up the dust in the immediate vicinity and cokes it; the scorching at great distances is caused by the heated air and by the coked dust; *Bedlington*, 5665. Coal dust aggravates an explosion of gas; 5666. Does not think it adds much to the flame or to the explosion; 5667–71.

The coal dust about the tips, on the roads, at the faces, and in confined places, may add to the force of an explosion initiated by some other cause; *Thomas*, 6201–203. Renders fire-damp more liable to explode; 6225.

COAL DUST AS THE MEANS OF PROLONGING OR EXTENDING AN EXPLOSION HOWEVER INITIATED:

For a short distance an explosion may be extended by means of coal dust; *Woods*, 5194. But only in exceptional cases; 5293–5295.

Is certainly of opinion that it will carry on an explosion; *Isaac*, 4941.

As long as there is dust in the air to feed the flames the explosion continues; *Forman*, 5048

If the flame reach the fine dust in the upper part of any of the galleries it would be ignited, and would serve to extend and carry the explosion further; but only to a limited extent; *Bedlington*, 5683–5692. Does not think the explosion would continue along the galleries so far as the dust extended because the flame due to the explosion of the gases would become weaker and weaker; 5738–5745.

Considers it proved by Sir Frederick Abel's experiments at Wigan and at Chatham, and also by the Prussian experiments, that coal dust alone could not cause an explosion, but that where flame is given off by the firing of a shot of gunpowder, the flame would, under certain conditions, ignite the surrounding coal dust, and would be considerably elongated by the addition of the flame of the coal dust; *Brain*, 5773. It is not possible for the coal dust to carry on the explosion to any great length; it may add additional fuel to the fire given off from another cause for a few yards, but the ignition, or inflammation, dies out at a short distance comparatively speaking; 5774. The coal dust itself, in the entire absence of gas, (which are the conditions existing in the Forest of Dean Collieries) is not a sufficiently explosive element to carry the flame to any appreciable extent; 5794. Differentiates between an inflammation and an explosion of coal-dust; 5895–5903. See *Mr. Brain's* evidence under "RADSTOCK DISTRICT," upon the case of a blown-out shot at Ludlow's Pit.

COAL DUST—*continued.*

An explosion once set up may be continued as long as dust exists; *Hood*, 5934, 5935.

Coal dust will extend the flame of an explosion, but only for a very limited distance; *McMurtrie*, 6128, 6129, 6130. The presence of coal dust a danger, but a very slight one; 6131. Where the flame from a blown-out shot is in immediate contact with the dust, it will, no doubt, cause combustion, which may extend to other coal dust, and so it may be extended along the face, but the effect decreases, and at the end of 30 yards practically dies out altogether; 6177. See *Mr. McMurtrie's* evidence under "RADSTOCK DISTRICT" upon the two cases of blown-out shots there.

Believes that coal dust is a danger in a mine in carrying on explosions initiated by some other cause, and is of opinion that it can carry on an explosion for a considerable distance; *Thomas*, 6198–6202. If there were an explosion of gas in a place where there was a considerable quantity of dust the explosion might be continued, and extended, and increased; 6217, 6218, 6238.

COAL DUST—QUANTITY IN SUSPENSION IN THE AIR:

The experiments that have been made do not represent the ordinary conditions of a mine in this respect; *Ashworth*, 4637.

The quantity of dust in the air in the ordinary working of a pit is not sufficient to explode; it must be raised from the ground, and the sides, and brought down from the timbers by the concussion from a shot; *Forman*, 5049, 5050; great concussion required to raise the dust—some shots do not raise enough dust; 5121, 5149.

COAL DUST—ITS INFLAMMABILITY VARIES IN DIFFERENT KINDS:

Has no doubt that some kinds are more explosive than others; *Morgan*, 4818.

The coal dust in the travelling roads finer than that at the working faces and more dangerous; *Isaac*, 4998–5009.

The dust in the working faces comparatively safe; *Forman*, 5081.

The shale and stone dust produced by the roof ripping and bottom cutting in South Wales make the dust less liable to burn or inflame; *H. W. Martin*, 5353. Refers to Mr. Galloway's experiments with different kinds of dust in South Wales in which it was found that only the dust from the Rhondda Valley was explosive; the dust obtained from the neighbouring collieries failed to explode; 5355–60.

The quality of the dust varies; *Hood*, 6012.

COAL DUST EXPLOSIONS:

These explosions go in some cases with the air current, and in others against it; the direction depends upon the place of ignition and the track of the dust; *Forman*, 5052.

No force is exhibited for about 60 or 90 yards on each side of the shot; in a gas explosion force would be exhibited at once; *Forman*, 5074–6.

COAL DUST—CAKED:

Has never seen caked or coked coal dust after any explosion; is suspicious of the statements as to its existence; *Woods*, 5195–200, 5247–51.

DIXON, PROFESSOR H. B.:

Of University College, Manchester, and a member of the Commission. Has made many experiments with various safety lamps, and finds that Professor Clowe's hydrogen lamp detects one quarter per cent. of fire-damp; 6723–6, 6737. He tested the air with Clowe's hydrogen lamp in several places at Camerton Colliery after the explosion and could detect no trace of gas; 6727–31, 6738.

Has visited the scenes of various colliery explosions; 6732–5, Appendix XXI.

DOWLAIS IRON COMPANY'S COLLIERIES:

Output last year; *H. W. Martin*, 5332. Produce steam coal and bituminous coal; 5335, 5512. Not what are called dusty mines; 5336, 5345. The Evan Thomas bonneted clanny is in use in some of the collieries: naked lights in others; 5337, 5420. Shot firing at the rate of 383 to 400 shots per day; 5339. The steam coal collieries are subject to fire-

DOWLAIS IRON COMPANY—*continued.*

damp: the bituminous collieries entirely free from fire-damp; 5340. Naked lights used in the steam coal collieries; 5341, 5342. Several slight explosions have occurred in the steam-coal collieries: none whatever in the bituminous; 5344, 5513–16. For the spray system of watering at these collieries, *see* Mr. Martin's evidence under "WATERING." Working all the known seams in the Merthyr and Aberdare Valleys; 5417. Thinks the most dusty seam is the nine feet; 5418. As to which seam is the most fiery, it depends on the kind of roof and the position of other seams above and below; 5419; Are working with naked lights where there are precautions against dust, but not where the dust is considered dangerous, or where there is gas; 5421–30. Watering adopted as a preventive against danger; 5431–5437. Explosives very largely in use; 5438–5442. No complaints with regard to fumes from gelignite or roburite; 5496–5499. The workmen examine the mines under the 30th general rule if they choose to do so, but they do not care about giving up the time; 5477, 5478. Remove the dust in trams; not necessary to brush it away, if watering is carried on; 5509–5511. All the pits except the bituminous worked by longwall; 5517, 5518. The precautions taken when shot-firing; 5519–5522. Does not know that they have had a single explosion caused by firing into gas; 5523, 5524.

DURHAM COLLIERIES:

Would prohibit gunpowder altogether in the county of Durham; *Forman*, 5086–5091. Would not think it necessary to prohibit the high explosives as they are much safer; 5092–5102. Gunpowder is largely used in the west but not in the eastern portion of the county; 5103–5108. The wedge referred to: not extensively used in Durham; very severe work and the men prefer to use roburite; 5122–5129. The provision of the Mines Act which enables the men to examine the mine is put in force, but rather with regard to the ventilation and the roof than to dust; 5130–5136. There are means of watering, but it is not done, witness believes, at the working faces; 5141. Cannot conceive of gas being present in the rock in Durham; 5154–5156. Only the more intelligent of the men think there is any danger in coal dust; 5164–5166.

DUST-TIGHT WAGGONS: recommended; *Garthwaite*, 6415, 6416.

DYNAMITE:

Described as being highly inflammable and having a large flame; *Isaac*, 4992, 4993. Use it in strong rock, especially after a blown-out shot of gunpowder, 4995. The fumes from it are worse than those from gunpowder; 4996.

Used for rock roofs; *Bedlington*, 5705.

ELECTRIC FUSE:

Has invented a system of electric firing, which he describes; *Brain*, 5819–25.

ELECTRICAL CONDITIONS:

Produced by a shot blowing out across ropes, chains, rails, signal wires, &c.; the explosions at Altofts, Elemore, and Sladderhill, referred to as cases in point; *Ashworth*, 4634–37, 4668–76, 4766, 4775–84.

ELEMORE EXPLOSION:

Entirely a dust explosion; *Ashworth*, 4622. Originated by a shot; 4623. The friction and heat of the shot blowing out across the chains, rails, signal wires, &c., would in witness's opinion set up an electrical condition which disturbed the dust all along the roads; 4635, 4636, 4670, 4671, 4676. The shot faced the air current; 4720.

A dust explosion; *Forman*, 5069–73.

EXPERIMENTS, IF MADE BY THE COMMISSION:

They should represent the conditions of a mine, that is, they should be made in a velocity of air passing at from 30 to 50 feet a second and with a water gauge of not less than 2½ inches. Rails, ropes, and chains, should be provided to prove whether these in conjunction with a blown-out shot set up electrical conditions which disturb the dust from the tops of the timbers and the sides of the roads; *Ashworth*, 4652. Suggests a tube made in wrought-iron box girder form about 30 inches square; 4654, 4655, 4728. The chamber should not be less than 150 yards long in a straight line, and should be syphon shaped to represent the upcast and downcast pits; thinks that the telephone might be used to record the vibrations caused by a blown-out shot; 4656. Thinks experiments should be made with the various kinds of gunpowder and other explosives; 4657, 4658. Is of opinion that it is not necessary to have a gallery the same size as the gallery of a mine; 30 inches square would be big enough; 4663, 4664. Believes that experiments in such a chamber would be accepted as conclusive; 4665. Suggestions as to the shape of the chamber; 4729–32.

Thinks that the Commission should make experiments to settle the question; *Forman*, 5158. The gallery should not be less than a quarter of a mile long as the force of the explosion gradually increases, and in the first stage is merely an ignition; 5159. The gallery should be the same size as the gallery of a mine; 5160, 5161. In order to be clear of gas it should be on the surface; 5162. Experiments in a disused mine would not be accepted as conclusive; 5163, 5174, 5175.

Perfectly satisfied without further experiments that dust is dangerous, but believes there are still people who desire further proof; *H. W. Martin*, 5502–04.

Further experiments are certainly necessary as there are still a great number of people who do not believe in the danger of coal dust; *Wilkinson*, 5644, 5645. A chamber two or three hundred yards long would hardly meet the case; it should be about eight feet by seven feet—the width of an ordinary heading: should be on the surface; 5646–55. The experiments most required are those which relate to the comparison of different kinds of explosives; 5656. Would be an advantage to convince the workmen of the danger of coal dust; 5656, 5657.

To prove that coal dust will cause an explosion in the absence of gas thinks that the experiments should be made with dust from a vein of coal which is known to be free from fire-damp; *Bedlington*, 5715–29.

Suggests a chamber built on the surface corresponding in size to the roadway of a coal face of the Radstock mines; 400 or 500 yards would be a satisfactory length, and about 6 ft. × 7 ft.; *Brain*, 5910–22.

Perfectly satisfied as to the dangers of coal dust without further experiments, but would like to see experiments with coal dust, and the various kinds of explosives to ascertain to what extent the high explosives are flameless or will ignite coal dust; *Hood*, 6029–33.

There could be no better test than to have some disused coal mine, or district of a coal mine, in which the actual conditions of a mine would be present; must be a mine free from gas; *McMurtrie*, 6139–47.

Is quite satisfied without further experiments; *Thomas*, 6289. Thinks it would be useful to have experiments with the different explosives by way of comparison; 6292–95.

EXPERIMENTS WITH LAMPS AND DUST BY THE MINING AND MECHANICAL INSTITUTE OF NORTH STAFFORDSHIRE:

Ashworth, 4638–42, 4704–12, 4733–43.

EXPERIMENTS OF THE ACCIDENTS IN MINES COMMISSION WITH LAMPS:

Ashworth, 4767–74.

EXPERIMENTS OF SIR FREDERICK ABEL WITH COAL DUST:

Ashworth, 4637.

Witness is of opinion that Sir Frederick Abel's experiments at Wigan and Chatham prove that coal dust alone will not cause an explosion, but where flame is given off by the firing of a shot of gunpowder, the flame would under certain conditions ignite the surrounding coal dust and would be considerably elongated as a consequence by the addition of the flame in the coal dust; *Brain*, 5773, 5786.

EXPERIMENTS OF THE CHESTERFIELD AND DERBYSHIRE INSTITUTE:

The velocity not sufficient; *Ashworth*, 4652.

Thinks the apparatus was far too small to set up an explosion of dust; *Forman*, 5152; 5156–58.

EXPERIMENTS WITH EXPLOSIVES BY THE NORTH OF ENGLAND INSTITUTE OF MINING ENGINEERS:

The shape of the chamber; *Ashworth*, 4732.

The chamber far too small for coal dust explosions; *Forman*, 5167–73.

EXPERIMENTS BY MR. HALL:

No analogy between these experiments and a coal mine; *Woods*, 5187–88.

Not a fair example of the conditions which prevail in a coal mine; *McMurtrie*, 6137–38.

EXPERIMENTS BY MR. GALLOWAY:

In the experiments at Dowlais he only obtained explosions with dust from the Rhondda Valley. Failed to obtain explosions with dust from the neighbouring collieries; *H. W. Martin*, 5355–60. Ignited dust with the flame from a blown-out shot; 5479–82.

EXPERIMENTS—GERMAN:

Witness thinks that these experiments have proved that coal dust alone will not cause an explosion, but where flame is given off by the firing of a shot of gunpowder, the flame would under certain conditions ignite the surrounding coal dust, and would be considerably elongated as a consequence by the addition of the flame in the coal dust; *Brain*, 5773. Thinks they proved that the utmost limit coal dust alone would carry a flame is 70 feet, and that coal dust alone was not to be considered dangerous and as causing explosions in mines; 5786–90. Accepts a correction as to the statement that coal dust would not carry an explosion further than 70 feet; 5825–36.

Believes that the only experiment which gave an explosion of coal dust was that from the Pluto seam; *McMurtrie*, 6136–38.

EXPLOSIVES:

Has had no practical experience with bellite, but believes it to be safe even with an insufficient quantity of stemming. There have been accidents with securite and roburite, but supposes they are absolutely safe if all the conditions are fulfilled; *Ashworth*, 4686. Proved that if the heat of the explosive is reduced, by the time it gets outside the hole, to less than 2,732 degrees Fahrenheit, the gas cannot be ignited; 4627. The foregoing statement is taken from the report of the French Commission; 4688, 4689. In the present state of knowledge all explosives should be protected; 4649, 4650. As liable to have an explosion with a high explosive, if it is not properly detonated, as with the best gunpowder; 4629.

Knows of no explosive which can be relied upon to give no flame. Has seen experiments with bellite and did not see any flame upon that occasion; *Morgan*, 4826, 4828, 4845. The flameless explosives not so effective as gunpowder; 4831. But safer, 4832. Not suitable for rock; 4834, 4835. Has not had much experience personally with these explosives, but the experience of the men points in this direction. The workmen consider roburite altogether ineffectual and object to the fumes it gives off; 4846–48, 4916–4924. A flameless explosive is an advantage if of the same strength as the ordinary powder; 4854. The flameless explosives are not much used in South Wales; 4915.

Has seen large flame from dynamite; *Isaac*, 4992–94. Used it in rock; 4995. Fumes from dynamite worse than from gunpowder; 4996.

Considers the high explosives to be much safer than gunpowder and as effective; *Forman*, 5086–90, 5100. Speaking for Durham thinks they are as handy as powder; 5091. Has seen experiments with roburite: states that there is sometimes a scintillation, but scarcely a flame; 5092–95. A Committee of inquiry arrived at the conclusion that though the flames of roburite were unpleasant they were not injurious; 5095, 5096. Could not say that roburite is absolutely safe; 5097, 5098. Roburite used at Hetton, and tonite at South Hetton, 5099. Some mines could not be worked without explosives, and even if it were thought advisable to prohibit the use of gunpowder, the prohibition should not extend to the high explosives; 5101, 5102. Gunpowder used in West Durham where there is very little gas; 5103–105. Very little gunpowder is used in East Durham; 5106–108.

Thinks that some of the patent explosives might be used with perfect safety if under proper supervision; *Woods*, 5217. They are all liable to explode gas; 5302, 5320. Case in Lancashire in which a man is said to have been poisoned by the fumes from roburite; 5321–5323. Experiments by the Manchester Geological Society showed that there was a glare with roburite; 5324. The patent explosives safer than gunpowder but less effective; 5325. With regard to the prohibition of explosives, *see* Mr. Wood's evidence under "PRECAUTIONS."

Does not think that any of the so-called flameless explosives are really flameless; *H. W. Martin*, 5443, 5447. Roburite shows less flame than the others; 5444. A most serious thing to the South Wales mines if explosives were entirely prohibited; 5445, 5446. Is using roburite and gelignite and as yet has had no complaints with regard to the fumes given off; 5496–99.

Has been using ammonite for the last two or three years with gratifying results; has had no complaints from the shot firers of their having seen flame, and no complaints whatever about the fumes; ammonite is as strong as any of the high explosives—gelignite, dynamite, or any of them—and witness prefers it to all others; *Wilkinson*, 5561–64. Has tried the compressed cartridge as used in Staffordshire with very gratifying results, but found it very expensive; 5565. Considers ammonite perfectly flameless according to his experience and the experiments he has made with it; 5583. The exclusion of explosives would increase the cost of working the mines with which witness is connected to the extent of a shilling per ton, or even more; 5623, 5624.

None of the high explosives are used in the Forest of Dean; *Brain*, 5816. Certainly not necessary to prohibit gunpowder; 5815.

Has tried all the so-called flameless explosives and prefers gelignite, if tamped with wet peat it is practically flameless; *Hood*, 5995, 6018–23. Would like to see experiments with explosives and coal dust in order to ascertain to what extent the high explosives are flameless, and whether they will ignite coal dust; 6030–33.

Has experimented with all the patent flameless explosives and finds that they will not ignite dust; has tried in this way ammonite, bellite, and Ardeer powder; each show a little flash, but not continuous enough or strong enough to ignite the dust; the danger from blown-out shots would be materially reduced by the use of these explosives; *Thomas*, 6230–36. Knows of no explosive that is absolutely flameless; 6278. Does not think these patent explosives would fire the dust, but would not use them in the Welsh steam coal measures without watering; 6279–86, 6293.

The high explosives may be objected to because they require special care in handling; *Garthwaite*, 6357, 6358. Perhaps to substitute them for gunpowder would entail an increase in cost—say one-third; 6359–67.

Although not actually flameless, are much safer than gunpowder and should take its place; *J. S. Martin*, 6601, 6602. The extra expense would be trifling; 6603, 6632–40, 6651–55.

See also under "BLASTING," "BLOWN-OUT SHOTS," "GUNPOWDER," "PRECAUTIONS," "WATER CARTRIDGE," "AMMONITE," "ARDEER POWDER," "BELLITE," "DYNAMITE," ROBURITE," and "TONITE."

FIREDAMP:

Believes all explosions are due to firedamp; *Woods*, 5201, 5305, 5311–5314.

States that all the explosions of which he has any knowledge have been caused by gas; *H. W. Martin*, 5361. Refers to the explosion at the Pochin Pit, Tredegar: thinks it was initiated by gas, and aggravated and extended by dust; 5362, 5363.

During an experience of fifty years in South Wales, does not know of a single colliery explosion that was not caused by gas; *Bedlington*, 5663, 5664. Gas is evolved from very fine coal dust; 5713.

Is given off by coal dust, but more when it is fresh; *Thomas*, 6276.

FOREST OF DEAN COLLIERIES:

Trafalgar Colliery, one of the largest mines in the Forest of Dean, employing about 750 men; *Brain*, 5755. This particular colliery is somewhat damp, and scarcely dry and dusty; 5841–47.

Explosive gas has never been found in the Forest of Dean; *Brain*, 5760, 5863. Quite free from explosions either of gas or of dust; 5761, 5762, 5785, 5901. Some of the mines are dusty, and shot firing with gunpowder is largely practised; 5763, 5764. Occasionally there are blown-out shots, but witness has never known one to be followed by an explosion; 5765, 5766. Resolution passed by the Managers of the Somersetshire, Bristol, and Dean Forest Collieries, maintaining that the coal dust of the *non-fiery* seams of these districts will not *per se* cause an explosion, and has never been known to explode, and containing suggestions with regard to future experiments; 5799. Witness states that coal dust itself in the entire absence of gas—as is the case in these collieries—is not a sufficient explosive element to carry the flame to any appreciable extent; 5794, 5854. Does not think it necessary to water the dust in the Forest; 5805, 5890. Would take no extra precautions against coal dust in this district; 5808, 5886. Does not think that any precautions are necessary with reference to shot firing, beyond those which are at present observed with regard to the proper placing of the shot; 5813, 5814. Certainly not necessary to prohibit gunpowder; 5815. Uses no flameless explosives; 5816. Powder cheaper than the other explosives, and under certain circumstances it may do its work better; 5817, 5818. Shot firing; 5848, 5849. The length of the flame from blown-out shots; 5857–59. Candles and lamps used; 5860. Does not find it necessary to put into force the provisions of the Mines Act with regard to dust; 5889. Unnecessary to clear away the dust before shot firing; 5891.

Would not consider it a danger to set off more than one shot at a time; *Brain*, 5892–94. Refers to Mr. W. N. Atkinson's Report on the state of these collieries (*see* First Report, Appendix XI.), and inquires why, since some of these mines are reported as dry and dusty, and thousands of gunpowder shots are fired annually, they have never had the slightest experience of an explosion; 5901–3, 5922.

FRENCH COMMISSION:

Recommendations with reference to stemming; *Ashworth*, 4632. Stated that if the heat of the explosive is reduced to 2,732 degrees Fahrenheit the gas will not be ignited by the flame; 4627, 4683. Witness understands that it was proved that it was dangerous to fire a shot directly facing waste or gobbing; 4759.

FORMAN, JOHN:

President of the Durham Miners' Association; 5035.

Gives his evidence as his own and not after consultation with his council; 5114, 5115.

Has studied the question of explosions in mines and is of opinion that coal dust plays an important part in some of them; 5036, 5037.

To create or extend an explosion coal dust must be present in the immediate neighbourhood of a shot; 5038.

The dust must be dry and fine; 5039.

Knows from experience that there is flame from an ordinary shot. An ordinary strong stone shot is equally as dangerous, if it is overcharged, as a blown-out shot; 5040, 5119–21.

There must be a certain amount of concussion to throw the dust in the air; 5041.

The dust may be ignited either by the flame from a blown-out shot, or by the flame from an overcharged shot. If a shot is overcharged it is almost certain to have flame; 5042–44.

A large amount of dust required to produce an explosion; 5121, 5149.

Having been ignited by a flame from a shot, the particles of dust, if finely divided and surrounded with air, ignite each other and generally extend, and the temperature rises to such a height that the dust explodes; 5045–47.

The explosion may be carried on as long as there is dust to feed the flames; 5048.

The quantity of coal dust in the air in the ordinary working of a pit is not sufficient to explode. It must be raised by a shot, and there must be a large quantity of fine dust adhering to the sides, timbers, and floor. There must be a quantity of dust floating in the air before it will ignite; 5050, 5051.

FORMAN, JOHN—*continued*.

The explosion may go with the air or against it. It depends upon where the ignition is and the track of the coal dust; 5052.

Was for twelve months engaged in exploring Seaham Colliery after the great explosion in 1880. The disaster was due not to a blown-out, but an ordinary, shot; 5053–58.

Impossible for gas to have been given off from the strata; 5154–55.

The ventilation was too good to allow gas to be present; 5059, 5060.

A coal dust explosion entirely; 5061.

Describes an explosion at Seaham in 1871, and attributes it to dust; 5062, 5063.

Examined the scene of the explosions at Trimdon Grange, Tudhoe, and Usworth. In all these cases, believes that dust was the prime agent, because the ventilation was so good that there could not possibly have been any gas. It is to be noted that the explosions followed the dust and avoided the damp; 5064–73.

In all the explosions which are considered to be dust explosions no force is exhibited for about sixty to eighty yards on each side of the shot. The explosion gathers force as it goes. If in these cases gas had been the agent instead of dust, witness contends that the force would have been exhibited at once, or at any rate much quicker; 5074–76.

Believes the 12th General Rule to be a good rule, but thinks that the 4th General Rule ought to be amended a little. In addition to reporting when gas is seen, it would be well if the Rule could be altered to require a report to be put on record where there is an accumulation of coal dust; 5077, 5078, 5109–13, 5138–40.

Where there is any great quantity of dust it should be removed; 5079.

Recommends watering, especially in the intake roads, or in places where there is an accumulation of dust 5080–82.

It is not practicable to water the working-faces, but in general these are comparatively safe; 5081, 5141.

Thinks the General Rules are very good if properly carried out, with the addition named above to General Rule 4; 5083–85.

Speaking as regards his own county of Durham, would prohibit gunpowder altogether. Considers it very dangerous and thinks the high explosives are safer. There may be a scintillation from roburite, but scarcely a flame. Thinks it gets the coal just as well as powder; 5086–94.

A committee formed in Durham to examine into the question of the fumes given off by roburite decided that they were not injurious; 5095–96.

Cannot say that roburite is absolutely safe where there is gas, but if gunpowder were prohibited he would not extend the prohibition to the high explosives; 5097–5102.

Thinks some mines could not be worked without some kind of explosives; 5102.

Gunpowder is largely used in the western part of Durham, but very little is used in the eastern portion; 5103–108.

A damp place a few yards wide would arrest an explosion; 5116–18.

The wedge is not much used in Durham. It answered very well, but it is very hard work, and the men prefer roburite; 5122–29.

The provision of the Mines Act, 1872, which enables the workmen to examine the collieries, is put into operation in Durham, but the examination extends only to the ventilation and the roof and not to the dust. The men would laugh if they were asked to examine for coal dust; 5130–36.

Coal dust by itself is able to form an explosion without gas; and where there is a small quantity of gas the presence of coal dust very much stimulates and increases the power and danger of an explosion; 5137.

Speaking for Durham, does not think that the rule with regard to the firing of shots in dry and dusty places is carried out in the faces; 5142–49.

Thinks the apparatus in the Chesterfield experiments was too small to obtain an explosion with dust in the absence of gas; 5150–53, 5156–58.

FORMAN, JOHN—*continued.*

If experiments are carried out by this Commission, they should be made in a chamber not less than a quarter of a mile long. It should be about the size of a gallery in a mine, and should be on the surface; 5159–62; 5167–73.

Experiments in a disused mine would not be conclusive; 5163, 5174, 5175.

GARFORTH, MR. W. E.:

Microscopical examination of coal dust; *Ashworth*, 4637.

GARSWOOD PARK COLLIERIES EXPLOSION:

No trace of caked or burnt coal dust; quite unconsumed; *Woods*, 5195.

GARTHWAITE, THOMAS YOUNG:

General manager of the Camerton Colliery, near Radstock; 6296–98.

Names the seams worked at this colliery; 6299–304.

Describes the state of the mine as regards ventilation, gas, and dust, the mode of working, and faults in the strata; 6305–19, 6350–53, 6373–90, 6404–13, 6421–29, 6441–46, 6453, 6462, 6486–88.

The circumstances attending the explosion at the colliery on 13th November, 1893; 6320–49, 6391–403, 6414, 6419, 6420, 6430–40, 6447–52, 6463–85, 6489–91.

Recommends watering and the removal of the dust, and the substitution of a high explosive for gunpowder in the roadways; 6354–56, 6417, 6418, 6443.

The objections to the use of high explosives; 6357–70.

He is convinced of the truth of the coal dust theory; 6371, 6372.

Suggests the use of dust-tight waggons; 6415, 6416.

GELIGNITE OR GELATINE DYNAMITE:

Used at Apedale; in the habit of using a water cartridge with it, but omitted to use it with the shot which caused the explosion; *Ashworth*, 4697–702.

Used at the Dowlais Company's Collieries; 5442. No complaints about the fumes; has only recently adopted it; *H. W. Martin*, 5496–99.

When tamped with wet peat it is practically flameless; *Hood*, 5995.

Has seen a small flame from it with dry stone dust as tamping; 6018–23.

GLAMORGAN COAL COMPANY'S COLLIERIES:

Describes the precautions taken against dust; watering arrangements, shot firing, use of gelatine dynamite; *Hood*, 5948–6039.

GUNPOWDER:

See Appendix XIV., handed in by Mr. Ashworth showing the effect of a blown-out shot of gunpowder upon the atmosphere; *Ashworth*, 4625, 4792–4802. These calculations are made to show that an atmosphere, which is not explosive in the ordinary way, becomes explosive by the addition of the ingredients arising from the blown-out shot; 4793. And also to prove that a powder of good quality, and of a certain density, may be fired by a detonator with almost perfect safety; 4626. Very difficult to get a blown-out shot with such a powder, but if a blown-out shot occurs "would not say that you "would not get somewhat of a disaster, because "you get a flame"; 4627. Stemming very important; 4629. Common black powder should not be used in dry and dusty mines, but only powder of the best quality; 4645. Density of powder an important consideration; 4677, 4678. "E.S.M." powder less likely to produce a blown-out shot than an ordinary black powder; 4679–83. In the present state of our knowledge would not use the "E.S.M." powder in a fiery mine unless it were further protected; 4684. Thinks it safe because the protective qualities are inseparable from the explosive itself; 4685. Witness uses it, but does not know where else it is employed; 4687, 4744. Always uses it in any place where there is any gas or risk whatever; 4745. No case of a blown-out shot with it; 4746. This is due principally to the composition of the powder; 4747. Composition of the "E.S.M." powder; 4789–91.

GUNPOWDER—*continued.*

To forbid the use of gunpowder in South Wales mines would be a blow to the industry; *Morgan*, 4829, 4830, 4862–65. And would stop something like one-fourth of the collieries; 4833. Where watering is effectually done by sprays and the moisture carried in by the intake, gunpowder can be used with little or no risk in the South Wales pits; 4841–44. Gunpowder should be prohibited in places where there is dust and a danger of gas, providing an effectual and flameless explosive can be got; 4857–59. More powder is used in South Wales than is necessary; 4866–68, 4872, 4873.

Would prohibit gunpowder in the county of Durham; thinks it very dangerous; believes the other explosives to be quite as effective as gunpowder and much safer; *Forman*, 5086–92.

There will always be a danger of explosions so long as gunpowder, or any other kind of explosive is used in mines which give off a large quantity of gas; *Woods*, 5203.

Has excluded gunpowder from the pits under his charge; *Wilkinson*, 5622.

Largely used in the Forest of Dean, and would certainly not prohibit its use in this district; *Brain*, 5815. Cheaper than the high explosives, and under certain circumstances does the work better; 5817, 5818.

Does not use it in dusty mines; *Hood*, 5991.

Experiments which he has made show that gunpowder and low explosives will ignite coal dust; *Thomas*, 6226–29.

Should not be used in dusty places; *Garthwaite*, 6353–56, 6418, 6443.

Should be entirely prohibited; *J. S. Martin*, 6601–603, 6632–40, 6652.

See also under "BLASTING," "BLOWN-OUT SHOTS," "EXPLOSIVES," and "PRECAUTIONS."

HAYDOCK EXPLOSION:

In the Wood Pit; *Ashworth*, 4620. The gas present in the air, mixed with the coal dust, exploded at a Davy lamp; 4621, 4640.

HIGH BROOK COLLIERIES EXPLOSION:

The coal dust quite unburnt and unconsumed; *Woods*, 5196.

HOOD, WILLIAM WALKER:

General manager of the Glamorgan Coal Company; 5923.

Believes that coal dust is inflammable without the presence of gas, other than that contained in itself; 5925.

Explodes, or inflames, by simple contact with the heat; 5926, 5927.

A candle has not sufficient flame to inflame or explode it; 5928.

Coal dust will explode at the coke ovens; 5929, 5930.

A blown-out shot would explode it, and the explosion once set up would be continued indefinitely as long as the dust exists; 5931–35.

Believes that the explosion at Pen-y-Graig was initiated by gas and continued entirely by dust; 5936–40, 6002–10, 6035, 6036.

Believes that the explosion at the National Colliery, in 1887, was a dust explosion, and that it was arrested by water on the roadways; 5941, 5942.

Does not think it necessary to take any precautions beyond those in the General Rules; 5943–49, 6028.

Thinks that if a space of twenty yards is watered round about where the shot is to be fired, it is not necessary to water all the roads except for the comfort of the men; 5950–52.

Looks upon the compressed air system of damping as the best; 5953–60.

Witness claims that he gets nearly the same result by the pressure of the water, without introducing the air; 5961–64.

Explains his own system of watering with a spray, and describes its effect upon the atmosphere. Thinks that if such a system were adopted, no other precautions, beyond those already taken, would be necessary; 5965–90, 6011–17, 6037–39.

Speaking of the mines under his charge, does not use gunpowder in dusty mines. Uses gelatine, and has seen flame from it; 5991–95, 6018–23.

Has had the dust in the roads analysed to show the moisture in the coal, and the moisture in the dust after watering; 5996.

HOOD, William Walker—*continued.*

Describes the effect of dust put into coke ovens; 5997–6002.

Has seen a flame from a blown-out shot extend five or six feet; 6024–27.

Would like to see experiments with coal dust, and the different kinds of explosives; 6029–33.

Believes that coal dust will ignite at a torch, but the dust must be so thick that it would be impossible to live in such an atmosphere; 6034.

HYDE EXPLOSION, January 18, 1889:

Gas brought down by a fall of roof; *Woods*, 5258–62.

ISAAC, Thomas Daronwy:

President of the Rhondda Valley Labour Association. Worked in the South Wales mines as a collier for nearly 30 years; 4934–38. Believes that "coal dust "will explode in itself when the air is very hot in "fiery mines," and will carry on an explosion; and therefore is a danger to be guarded against; 4939–42, 4958, 5021.

With regard to precautions, believes that it is impracticable to water the dust at the working faces, and suggests that mines should be worked in smaller sections with a fresh current of air for each section; 4943–46, 4951–55, 4977–91, 4997–5200.

Recommends removal of the dust, and the watering of the main roads by a patent watering tank; 4947–51.

States that there is generally flame from a blown-out shot; 4956, 4957, 4966–75.

Blown-out shots are generally due to undercharging; also to insufficient tamping and inexperience; 4959–65, 5028–34.

The system of watering adopted at Mardy is not sufficient to lay the dust in the faces; 4976–79.

Has used dynamite in very strong rock. Has seen much flame from it. Its fumes are worse than those from gunpowder; 4992–96.

Has seen the dust igniting in the gauze of his lamp: 5021–3.

It is not his impression that any recent explosions in South Wales, say within the last 10 years, have been caused by coal dust alone; 5024, 5025.

LAMPS:

The explosion at Swaithe Main, Barnsley, was caused by a Stephenson lamp passing a mixture of fire-damp and coal dust through the gauze; *Ashworth*, 4601–604. The explosion carried on by coal dust over the whole mine; 4605–608. Refers to the explosion at the Wood Pit, Haydock, caused by a mixture of coal dust and gas exploding at a Davy lamp; 4620, 4621, 4640. Describes experiments at Harecastle with the Davy, Clanny, Williamson, Stephenson, and Gray, in an atmosphere charged with firedamp and coal dust; 4638, 4641, 4704–709. A Davy lamp in an atmosphere of coal dust and a small percentage of gas is unsafe; 4639, 4640. Thinks it necessary with every safety lamp, if the mine be dry and dusty, and giving out firedamp, unless the gauze is specially protected, that such lamp should have two gauzes. Mentions instances at Morfa Colliery, and Mossfields Colliery, where lamps have failed; 4642. In the former case it was a Marsaut with the gauze taken out, which reduced it to a Clanny; 4710–12. Various lamps described; 4733–43. Refers to the experiments of the Accidents in Mines Commission with lamps; 4767–74.

For the lamps and lights at Dowlais Iron Company's Collieries, *see* under "Dowlais."

The prohibition of naked lights would increase the danger from falls of roof; *H. W. Martin*, 5411–13. Has tried an electric lamp; 5471–75.

From practical experience is convinced that coal dust will not ignite at a lamp; it burns and inflames, but will not explode; *Thomas*, 6221–23. It makes very little difference if the dust is mixed with firedamp; 6224.

LANCASHIRE COLLIERIES:

The fiercest explosions have occurred in mines in which the ventilation has been the most perfect; *Woods*, 5190. Seams as hard as any in the country are being worked without any kind of explosive; 5206. Attributes the explosions that have taken place in Lancashire to gas, and states that the gas of the 9-feet seam is not easily perceived with the lamp, and so has escaped observation; 5191, 5192,

LANCASHIRE COLLIERIES—*continued.*

5252, 5262. Describes the method of dealing with rock roofs and floors; 5231–37. The coal can be won without explosives; 5238. Precautions with regard to shot firing; 5219, 5220, 5241. A great many of the Lancashire explosions have occurred in the coal face either through blown-out shots or the reckless use of gunpowder; 5288–90. As a rule coal dust has been present in these cases; 5291. To stop shot firing altogether in the Lancashire district would fall very heavily on collieries working the hard seams (the 9-feet, for example), but does not think there would be any serious loss; 5309, 5310. The wedge is not used in Lancashire; 5315. Roburite largely employed, and witness refers to the case of a collier who is said to have been poisoned by it; 5321–24.

LEYCETT EXPLOSION:

Due to an atmosphere charged with coal dust and a small per-centage of firedamp exploding by means of a safety lamp; *Ashworth*, 4640.

LIME CARTRIDGE:

Not effective in hard ground; *Morgan*, 4831, 4834. Lime tried in Wales 40 years ago, but without the mixture of chemicals with it; 4908–10.

Where the coal is friable it did more harm than good, but where the coal was hard it worked very well; *Wilkinson*, 5565.

LLANERCH EXPLOSION:

Due to a small explosion of gas carried on by dust; mainly a dust explosion; *Ashworth*, 4623.

LUDLOW'S PIT, EXPLOSION AT: *See* the case of the blown-out shot under "Radstock Collieries."

MALAGO EXPLOSION:

An explosion of fire-damp in which dust played a very large part: *J. S. Martin*, 6718–22. See *Professor Dixon's* notes, Appendix XXI.

MARDY COLLIERY EXPLOSION:

Believes that coal dust intensified the explosion; *Isaac*, 5025.

MARTIN, Henry William:

Mining engineer, Vice-President of the South Wales Institute of Engineers; a member of the Monmouthshire and South Wales Coal Owners' Association; and general manager for the Dowlais Iron Company's Collieries of South Wales, 5329–31.

Had an experience extending over 30 years in the management of collieries and iron-stone mines in the Aberdare district, the Merthyr district, the Durham district, and in Japan, 5333, 5334.

The Dowlais Collieries work steam coals and bituminous coals, and are not what are called dusty mines; 5335, 5336, 5345, 5417–19, 5512.

The Evan Thomas' Bonnetted Clanny is used in some of the collieries, and naked lights in others; 5337, 5420.

Shot firing is very largely employed; 5338, 5339.

All the mines are subject to fire-damp except the bituminous collieries. Gas has never been seen in these; 5340.

Naked lights are used in the steam collieries in which there is fire-damp, and in which precautions are taken against dust by watering, but not where the dust is considered dangerous, 5341, 5342, 5420–5437, 5519–24.

There have been several slight explosions in the steam coal collieries, but none whatever in the bituminous; 5343, 5344, 5513–16.

Thinks that coal dust aggravates explosions initiated by fire-damp; 5347–48.

The presence of coal dust increases the liability of fire-damp to explode; 5349.

Does not think that coal dust alone, in the absence of fire-damp, would cause an explosion under the ordinary conditions of a mine; 5350, 5476, 5501.

The thin seams of coal in South Wales are worked by longwall, but there is a great deal of roof ripping and bottom cutting, which produces shale and stone dust, and renders the coal dust less liable to burn or inflame; 5351–53, 5517, 5518.

Considers the damping of the dust to be the chief means of preventing the extension of explosions; 5354.

MARTIN, Henry William—*continued.*

Believes that the quality of the dust varies in different mines, and that some might be more inflammable than others. Refers to Mr. Galloway's experiments with different dusts; 5355–60, 5479–82.

Considers that the explosions of which he has any knowledge have been caused by fire-damp alone; 5361–63.

Would not trust dust at all under any conditions, even when mixed with shale and stone dust, without damping it. Thinks dust a danger to be guarded against; 5364–70.

The dust should, as far as possible, be removed from the main roads, and damping should be carried on in the main roads, where dust is the most dangerous; 5371–74, 5495.

Explains the system of damping which has been used in three of the Dowlais collieries since 1886, and which consists of compressed air and water; 5375–85, 5390–410, 5448–70, 5505–511.

By this system he claims that the dust is absolutely damped, but the removal of the dust is not thereby rendered unnecessary, 5386–89.

Believes that an explosion from coal dust is impossible with this system; 5403, 5404.

Thinks the danger from explosions, due to the use of naked lights in a colliery such as they have in South Wales, is not so great as would be the danger from falls of roof due to the want of a better light if naked lights were forbidden; 5411–13.

Thinks the spray system of watering could be adopted without the risk of damaging floor or roof; 5414–16.

Explosives are used in the Dowlais collieries on a very large scale. Dynamite, powder, roburite, and gelignite. Believes that roburite shows less flame than the others, but is of the opinion that none of the high explosives are flameless; 5438–44, 5447, 5496–99.

It would be a very serious thing to have explosives entirely done away with in the mines under his superintendence, 5445.

Has tried a new electric lamp; 5471–75.

Speaking with regard to his own collieries, the workmen do not largely avail themselves of the 39th General Rule of the Mines' Inspection Act to examine the mines; 5477, 5478.

Has never known a blown-out shot to ignite dust in the absence of gas, and thinks it impossible; 5483–88.

Would prohibit the firing of more than one shot underground at the same place, and at the same time, to prevent the risk of an inflammation of the dust, but does not think that such an inflammation could cause an explosion in the absence of gas; 5489–94.

Has come to this conclusion owing to the explosion at Altofts, which was consequent on the firing of three shots; 5533.

Thinks the practice of damping, as provided by the Mines Act, is pretty generally observed in South Wales; 5525.

Believes Altofts explosion was caused by gas; 5526–34.

MARTIN, Joseph Samuel:

Her Majesty's Inspector of Mines for the South-Western District, 6569–71.

Believes that coal dust alone may cause an explosion; 6572–75, 6600.

Is of the opinion that the explosions in Ludlow's Pit, Radstock, November 1891, and the New Pit, Camerton Colliery, were entirely due to dust; 6576–80.

Has had experience of a colliery explosion in Westphalia, 6597.

Gives evidence with regard to the Camerton explosion; 6581–99, 6612–31, 6657–59, 6671–717.

Recommends the entire prohibition of gunpowder and the substitution of a high explosive; 6600–604, 6632–40, 6648–55.

Thinks watering is desirable and necessary, but not totally effective; 6605, 6606, 6641–47.

Is of the opinion that shot-firing should be done by electricity and when the number of men in the mine is reduced to a minimum; 6607–11, 6656, 6662–67.

Watering in the South-Western District; 6660, 6661, 6668–70.

Believes that the Malago explosion was a fire-damp explosion extended by dust; 6718–22.

McMURTRIE, J.:

A mining engineer; past President of the South Wales Institute of Civil Engineers; has been managing the Radstock collieries, the property of the late Countess Waldegrave and her trustees, for nearly thirty years; 6040–44.

Describes the Radstock collieries. Entirely free from fire-damp; worked by longwall; produce a hard coal; two distinct groups of seams—the upper group called the Radstock, and the second group, or Farrington series; the dust for the most part pure coal dust, but with a certain amount of shale dust mixed with it; 6045–53.

Refers to Mr. W. N. Atkinson's report on the Radstock Collieries which appears in Appendix XI. of the First Report; 6053–55.

During the whole time that he has known these pits there has never been any explosion whatever, and blasting has been going on continually. About 20,000 shots are fired annually in the four pits under his charge; 6056, 6057, 6064–66.

When blasting, no precautions whatever are taken—no removal of dust and no watering; 6058–61.

Would describe the seams of the upper, or Radstock, series, as being not generally dry and dusty, but there are occasional engine planes and horseroads which are dry and dusty; 6062, 6063. In this series has never heard of a case—either in his own pits, or in any of the pits in the district—of flame from a blown-out shot being extended by the dust, still less of an explosion; 6067–69.

Would call the seams of the Farrington series moderately dry and dusty. These seams are described by Mr. W. N. Atkinson as the driest workings in the Bristol and Somerset coalfields, the dust of which appears to be pure enough to be capable of causing an explosion if raised and ignited; 6055, 6070–73.

Witness considers the Farrington seams to be more dry and dusty than the seams in the Forest of Dean, but on the whole not so dry and dusty as the South Wales seams, or the steam coal seams in the Rhondda Valley, 6074, 6075.

Since opening these seams of the Farrington series 15,000 shots have been fired—chiefly in the roads and not in the coal; 6076–80.

Describes a blown-shot in the middle pit in the lower, or Farrington, series. An extremely heavy shot in the stone; the charge consisted of 30 ounces of compressed powder; the seam at the point of firing was not dry or dusty; the place generally damp; the dust rather wet; the effects of the shot were felt at a distance of 300 yards away; blew out lights in that part of the pit; opened doors; reversed the ventilation for a few minutes; the effect was not confined to that part of the pit, but was felt at a point 154 fathoms higher up in the upper group of seams; 6081–6104, 6187–89.

Describes the case of a blown-out shot at the Ludlow pit, also in the Farrington, or lower group of seams. The charge consisted of eight ounces of powder; the props were charred at a distance of eight yards from the shot; the mine dry and dusty; the dust was not confined to the mere point where the explosion occurred, but extended under precisely the same conditions to the further end of the pit; would call it an inflammation, not an explosion; a man was burned at a place 80 feet from the shot; the effects felt by a man 124 feet away; 6105–30; 6151–78; 6182–86; 6190.

In the above two cases, witness is of opinion that the coal dust had the effect of extending the flame, but only for a limited distance; 6128–29, 6177; and thinks coal dust contributed to the force; 6130.

Believes that coal dust alone will not produce an explosion, and that although it may increase the effects of an explosion it will not do so to any dangerous extent; 6131–32.

Considers that the present Mines Act provides sufficient precautions. It has not been considered necessary to put into force in the collieries under his charge the coal dust provisions contained in the Act; 6133, 6134, 6179–81.

Alludes to the German experiments, and to Mr. Hall's experiments. Does not regard the latter as representing the state of things in a coal mine; 6135–38.

Recommends that future experiments should be made in a disused coal-pit; 6139–45.

Believes it to be conclusively proved that ordinary shot-firing in coal dust will not either cause a

McMURTRIE, J.—*continued.*

lengthened flame or an explosion in a coal mine. Speaks more particularly with regard to his own experience, and the class of dust in the mines that he has had to deal with. Would rather not express an opinion upon dust such as that which is found in the Rhondda Valley; 6146–50.

MICROSCOPICAL EXAMINATION OF COAL DUST:

Ashworth, 4638.

MORFA COLLIERY EXPLOSION:

Failure of a lamp; *Ashworth*, 4642. The explosion probably caused by gas from a goaf; 4712. The explosion arrested by a damp space of 70 yards; 4713.

MORGAN, DAVID:

Agent for the Aberdare and Merthyr Miners' Association, representing 8,500 men; 4810, 4811.
Gives evidence entirely on his own account and not after consultation with his association; 4869–71.
For 35 years worked in mines in South Wales which are fiery and dusty; 4812–15.
Believes that coal dust cannot be ignited by a naked light, or by the flame from a blown-out shot; but, if there should be an explosion of gas, is of opinion that the dust is kindled and plays great havoc, and that the explosion is carried to greater distances by the aid of dust; 4816–19, 4855, 4856, 4925–27.
The presence of coal dust is therefore a source of increased danger; 4820 4821.
By way of precaution recommends watering by sprays as practised in South Wales, but, even when this is done, it is still necessary to remove the dust till it is no more than a thin covering; 4822–25, 4839–44, 4857, 4897–4904.
Very desirable to get explosives which give no flame, but knows none which can be relied on in this respect; 4826–28, 4857–59, 4906.
Powder is much used in South Wales. To prohibit powder entirely would close one-fourth of the collieries in this district; 4829–30, 4862–65.
The so-called flameless explosives, such as bellite, are not so powerful as powder, and are objected to by the men because they give off fumes, and are not effectual in rock; 4831–35, 4845–48, 4915–24.
Water cartridges are used in Wales, but witness has no experience of them; 4836, 4837.
In the majority of cases believes that blown-out shots give off no flame; 4817, 4849–52, 4890–96.
In hot, dusty places, where there is any danger of gas, shot-firing should be prohibited unless a flameless explosive can be found; 4853, 4854.
Believes the law sufficient as it stands if carried out; 4860, 4861, 4905.
Thinks that powder may be used rather too extensively in South Wales; 4866–68, 4872, 4873.
Before shot-firing neither the hole which has been bored, nor the quantity of the charge, is examined by the man whose duty it is to fire the shot; 4874–80.
To adopt this course would reduce the number of accidents, but it would involve the employment of too many men, and the cost would be too serious; 4881–83.
Thinks the better plan would be to provide some specific training for the men, instead of leaving them to pick up their skill in a haphazard way; 4884–89.
The workmen in South Wales do not, as a rule, avail themselves of the provision of the Mines Act, which allows them to examine the mine themselves; but, when this inspection does take place, observation is directed rather to the ventilation than to coal dust; 4928–33.

MOSSFIELDS:

The failure of a lamp; *Ashworth*, 4642.

NAKED LIGHTS:

See under "COAL DUST AND NAKED LIGHTS," and "LAMPS."

NATIONAL COLLIERY EXPLOSION:

Dust undoubtedly played a part, but gas may have been present; an Abel's envelope used without the water; *Wilkinson*, 5568, 5569. The effect of damp places on the explosion; 5579, 5580.

NATIONAL COLLIERY EXPLOSION—*continued.*

A dust explosion: the spread of the explosion stopped by water on the roadways at the bottom of the downcast, and also at the bottom of the upcast shafts; *Hood*, 5941.
Caused by the careless use of a water cartridge; *J. S. Martin*, 6655.

PARK SLIP COLLIERY, TONDU:

See Professor Dixon's Report, Appendix XXI.

PEN-Y-GRAIG, OR NAVAL COLLIERY EXPLOSION:

A very dry and dusty mine: the explosion caused by a gunpowder shot igniting gas which fired the dust and carried the flame into the other portion of the colliery; the explosion fiercer on the main travelling roads where the areas were greater and the dust finer; the continuance of the explosion not to be accounted for by gas on account of the perfect ventilation; if a blower of gas had been the cause he would have expected to see some trace of it afterwards; *Hood*, 5937, 5940, 6002–10, 6035, 6036.

PRECAUTIONS:

Recommends the removal of the dust and the maintenance of thoroughly wet patches at intervals on the roads; *Ashworth*, 4643, 4644, 4713, 4715, 4717. Wet patches would only reduce the extent of an explosion; 4718. Every explosive should be used in a hole of reduced diameter in proportion as it is stronger than gunpowder; 4630–33, 4645. This is not an invariable practice; 4695, 4696, 4700, 4703. Explosives should not be used in any case where there are ropes, chains, rails, or signal wires anywhere in the line of fire, as the heat of the explosive blowing out across these ropes, chains, &c., sets up an electrical condition which disturbs the dust all along the roads; 4634–36. In every dry and dusty mine giving out fire-damp, every lamp, unless its gauze is specially protected, should have two gauzes; 4642. No shot should face a strong current of air; 4646, 4720. This applies specially to the main roadways, not to the working faces; 4759, 4765. Shots should always be fired electrically; 4647, 4725. The question of leverage—that is the length of the charge—is most important; 4648, 4691–94, 4784–86. It should be compulsory for the fireman to see the shot hole before it is charged, and to superintend the charging; 4662, 4726, 4727, 4758.
Recommends the removal of the dust as far as practicable, and also watering; *Morgan*, 4822–25, 4839–44, 4857. Shot firing—except with an explosive which will not give a flame—should be prohibited in hot places where there is dust and a danger of gas; 4853, 4857. Would dispense with gunpowder in such places if a flameless and effectual explosive can be obtained; 4858, 4859. The law with regard to shot firing is sufficient as it stands; 4860–62. Scarcely possible to remove the dust so clean that it would not be necessary to water; 4897. Attaches the most importance to the watering; 4898–4900. Thinks no further precautions are necessary as far as dust is concerned, but believes that explosives may be improved; 4905, 4906.
Watering a practicable precaution; *Isaac*, 4943. Not possible to water at the working face, and suggests that a mine should be worked in smaller sections with a separate current of air for each section; 4943–45, 4949–55, 4997, 5010–20. It would add to the expense to make such an alteration in an old, well developed colliery, but when a mine is opened upon this system the expense would not be material; 4946. In further evidence modifies the two preceding statements; 4980–91. Recommends the removal of the dust and the watering of the main travelling roads with a patent watering tank; 4947–51. 5027. Has seen the system of watering at Mardy Colliery where the water is under pressure and distributed in the form of sprays in the in-take; does not consider that the atmosphere in the intake is sufficiently saturated with moisture to lay the dust in the faces; 4976–79.
The Twelfth General Rule is a good rule, but the Fourth General Rule should be amended so as to require a report to be put on record when there is an accumulation of coal dust, as is at present the case with regard to gas; *Forman*, 5077, 5078, 5083–85, 5109–11, 5138–40. The dust should be

PRECAUTIONS—*continued.*

removed; watering should be done especially in the intakes, and in any place where there is an accumulation of dust; 5079–82. The working face is comparatively safe and it is not practicable to water there; 5081. In special places the dust at the working face might be dangerous; 5142–43. Would prohibit gunpowder in the county of Durham; 5086–93. Believes that the Twelfth General Rule—speaking with reference to Durham—is not strictly carried out in the working face; 5144–48.

Shot firing—no matter what kind of explosive is used, whether it be gunpowder, roburite, tonite, dynamite, or any of the other patent explosives—should be prohibited in mines which give off a large quantity of gas; *Woods*, 5203. Limits this to collieries where there is a liability to an irruption of gas; 5230, 5303–305. Knows of nothing to take the place of explosives except the wedge, and thinks it could be employed in all coal mines; 5204–6. To prohibit the use of explosives would of course increase the cost of working, but not very much, and witness does not think it would cause any mine to be closed; 5207–11, 5225–29, 5306–308. It would come very heavy on the hard seams; 5309–10. An exception might be made in the case of rock, and in pits where it was impossible to work without explosives: some of the patent explosives if under proper supervision, and at the proper time, might be used with perfect safety; 5216–19, 5239, 5240. There might be greater freedom in open light collieries, but witness's opinion is that no mine is safe from an irruption of gas; 5220–24. Nothing to suggest with regard to what is the common practice of not firing shots when there are not many men in the pit; 5241. If shot firing continues to be allowed in fiery seams, urges that the Mines Act should be literally carried out; 5242, 5243. If it is properly carried out, he has nothing further to suggest; 5244–46, 5300–302.

Would not trust coal dust at all under any conditions, even when impure and mixed with shale or stone dust, without damping it; *H. W. Martin*, 5366–70. States that the dust should as far as possible be removed from the main roads, and that damping should be carried on in the main roads; 5371–73. Not absolutely necessary to damp at the faces; 5374.

For the system of watering with a spray obtained by means of compressed air see *Mr. H. W. Martin's* evidence under "WATERING." Watering does not dispense with the necessity of removing the dust; 5388, 5495, 5509–11. No additional precautions are required with regard to the use of lights; 5412. The danger of an explosion arising from the use of a naked light is not so great as the danger, where safety lamps are employed, of falls of roof; 5412, 5413. A most serious thing if explosives were done away with in the South Wales mines; 5445. Suggests that a clause should be added to the General Rules to prohibit the firing of more than one shot in the same place and at the same time, because one shot may raise the dust and the other inflame it, although he does not believe that this could possibly cause an explosion; 5489–94, 5533.

Necessary to thoroughly water the ways and to saturate the atmosphere: *Wilkinson*, 5551. Also to use an explosive as nearly flameless as possible; 5559, 5560. Practically no danger from coal dust if a flameless explosive like ammonite were used and the air of the mine kept saturated; 5567. Necessary to remove the dust to a thin surface; 5567. The duty of reporting on accumulations of dust when they exist could not be left, in witness's opinion, to a fireman, or indeed to any individual; 5592–94. To prohibit the use of explosives in the mines under his charge would increase the cost of working by 1*s*. per ton, or even more; 5623, 5624. With ammonite, or an explosive that was absolutely flameless, would still think it necessary to take precautions with regard to dust as a matter of additional safety, and for sanitary reasons; 5625–28.

Does not think the precautions of the Mines Act against dust are really necessary, because in a very long experience he has never seen any ill-effects from coal dust; *Bedlington*, 5672–74. Does not consider the removal of the dust necessary except from a sanitary point of view; 5675, 5676. Thinks it advisable to use flameless explosives as a precaution against gas, but not as a precaution against dust; 5677–82, 5695. Difficult to remove dust in every part of a heading where it lodges in the crevices and timber; 5695.

Thinks that what danger there is is amply met by the present law; *Brain*, 5801–18. Speaking for the Forest of Dean, does not consider watering is necessary, and thinks extra precautions in this district superfluous: certainly there is no need to prohibit gunpowder; 5883–94.

Does not consider it necessary to take any additional precautions beyond those which are indicated in the General Rules; *Hood*, 5943–49. Thinks that if a space of 20 yards is watered round about where a shot is to be fired, it is not necessary to water all the roads: he does, however, water the roads for the comfort of the men in the mine; 5950–52. Impracticable to remove the dust: 5951. No precautions, when shot firing, are necessary beyond those which are already taken; 5990. If the present Mines Act is carried out thoroughly, thinks nothing else is required; 6028.

No further precautions are needed in the Radstock district beyond those contained in the present Act; *McMurtrie*, 6133, 6134.

Recommends the use of flameless explosives: the tamping of the high explosives should be with a damp and non-combustible material. Advocates the prohibition of explosives of the gunpowder class and recommends watering; *Thomas*, 6239–51.

Since the explosion in the New Pit, Camerton Colliery, the witness will carry out all the rules as to dry and dusty mines, and should consider it necessary to use a high explosive instead of gunpowder in the roadways; but considers that gunpowder may be safely used in the working faces; *Garthwaite*, 6353–56, 6418, 6443. The use of dust-tight waggons recommended; 6415, 6416.

Recommends the entire prohibition of gunpowder throughout every mine, and the substitution of a high explosive; *J. S. Martin*, 6601–604, 6632–40. Watering is a necessary precaution, but is not totally effective; 6605, 6606, 6643–47. During shot-firing the number of persons in a mine should be reduced to a minimum, and the firing should be done by electricity instead of by a fuse; 6607–11, 6653, 6656, 6662–67.

See also under, "BLASTING," "EXPLOSIVES," "WATERING," "REMOVAL OF THE DUST," "LAMPS," "ROBURITE," "SECURITE," "TONITE," "BELLITE," "ARDEER POWDER," and "AMMONITE."

RADSTOCK DISTRICT:

Refers to an explosion with a blown-out shot at the Ludlow Colliery, No. 4 pit: believes it to be a dusty pit: the mine not fiery where the accident occurred; *Brain*, 5767–71, 5837–40. Would hardly call it an explosion, but rather a prolongation of the flame from a blown-out shot, and, taking that view of it, it is strongly confirmatory of his opinion that coal dust, such as is found there, would not cause an explosion; 5772, 5800. The place where the shot was fired was dry and dusty: the flame from it appears to have ignited the dust immediately surrounding the place, and the flame was carried some few yards along the face of the coal: but only a few yards, although there was abundance of coal dust for hundreds of yards further on: if the coal dust had been sufficiently dangerous to give off an explosion, witness is at a loss to know why the flame was not carried on more than a few yards; 5774. Generally speaking the flame from a blown-out shot carries from 4 to 6 feet: in the present instance a man was burnt at a distance of 30 yards; 5775–77. No dampness whatever where the flame stopped, but an abundance of dry dust; 5778. The accident occurred not in a roadway, but in a new coal face being moved forward, and, therefore, the dust would be quite fresh, and would not be as fine as it is in the roadways; the dust exactly similar in character from the point of ignition to the point where the explosion ceased: fails to see why, if the coal dust was sufficiently fine to carry the flame 30 or 40 yards it should not carry it 100 or 150 yards, provided the coal dust theory is correct; 5779–94, 5854, 5855.

Use partly lamps, and partly open lights; *Brain*, 5861. Gas in some of the measures; 5862, 5906.

Further particulars with regard to the explosion at Ludlow's Colliery—the position of the shot, direction of current, &c.; *Brain*, 5864–82.

RADSTOCK DISTRICT—*continued.*

The Radstock Collieries consist of four working pits, and employ nearly 900 men: two distinct groups of seams—the upper group called the Radstock, which consists of six workable seams ranging from one foot to 2 feet 4 inches in workable thickness: the second group, or Farrington series consists of about six seams of about the same thickness, or perhaps slightly thicker; *McMurtrie,* 6043–45. The upper, or Radstock group, has been worked for a hundred years and there are no indications of fire-damp whatever: during the whole of this period so far as there is any record—and certainly within the 30 years that witness has known the district—there is not a single instance of gas having been found in the seams: longwall system of working: the coal very hard and compact: would not call them dry and dusty mines: but there are districts here and there where the strata are very dry and where there is a small amount of dust: the dust for the most part is pure, but there is a certain amount of shale dust mixed with it; 6046–55. Has never known an explosion in these mines; 6056. Blasting has been going on continually without any precautions such as removing the dust and watering; 6057–63. Fire 20,000 shots annually; 6064–66. Has never known a case in the pits working the Radstock series (15 mines in all) where there has been a lengthened flame—far less an explosion—as the result of a blown-out shot; 6067–69.

The Farrington, or lower group of seams, have been at work for about 50 years; the coal is more friable than the coal of the upper series, and may be called moderately dry and dusty; Mr. W. N. Atkinson, in his report on these collieries (*see* Appendix XI., First Report), says that the dust in this series appears pure enough to be capable of causing an explosion if raised and ignited. Witness thinks these seams decidedly more dry and dusty than the Forest of Dean seams, but not so dry and dusty as the seams in South Wales, or the steam coal seams of the Rhondda Valley; *McMurtrie,* 6070–75. They contain no trace of gas; 6168–70. Have fired about 15,000 shots in these seams since beginning to work them about six years ago; witness's attention has been called to two blown-out shots; the blasting has been chiefly in the roads; 6076–80.

Describes the case of a blown-out shot in the Middle Pit in the Farrington series; an exceptionally heavy charge of 30 ounces of compressed powder; a very great concussion; the explosion wholly due to the powder; the seam at the point of firing not dry or dusty; the dust rather wet; the effects of the explosion felt at a distance of 300 yards away; it also blew out lights, opened doors, and reversed the ventilation for a few minutes; the explosion not confined to the one part of the pit, but took effect at a point 154 fathoms higher up in the upper group of seams where the concussion was distinctly felt, and some doors were partially opened; *McMurtrie,* 6081–88, 6187–89. Believes that these effects were produced by the gunpowder alone, 6089–6104.

Describes the case of a blown-out shot in Ludlow Pit, and in the same series of seams, *i.e.,* Farrington; a charge of 8 ounces; an unskilful shot; the seam dry and dusty; the flame, as shown by the charring of the props, extended for a distance of 8 yards from the shot; opened doors at various places; a man slightly burned at a distance of 80 feet; its effects felt by a man 124 feet away; believes coal dust had the effect of extending the flame but only for a limited distance; thinks that the coal dust contributed to the force of the explosion: it no doubt lengthened the flame and added to the force; *McMurtrie,* 6105–32, 6151–78, 6190. Takes exception to the word "explosion"; cannot regard it as anything beyond a lengthened flame; 6168. No trace of gas 6169, 6170, 6182–85. The workmen did not regard it as an explosion; 6171, 6172. His experience in connexion with the working of these seams shows, in his opinion, that coal dust will not produce an explosion, and that although it may increase the effects of an explosion it will not do so to any dangerous extent; 6132.

Witness's evidence applies exclusively to these and to similar mines; considers that the present Mines Act provides sufficiently for all dangers; he, as manager of the mine, and the Government Inspector, have not considered it necessary to put into force the coal dust provisions of the Act; 6133, 6134, 6179–81, 6186.

The explosion in Ludlow's Pit was one of the explosions which led Mr. J. S. Martin to alter his views and to believe that coal dust *per se* is capable of causing an explosion. Regards it as an extension of flame due to dust; *J. S. Martin,* 6574–77.

See Appendix XXI. for Professor Dixon's Report on the Explosion in Ludlow's Pit.

REMOVAL OF THE DUST:

Great care is taken in Durham to remove the dust; *Forman,* 5112, 5113.

See also under "PRECAUTIONS."

RISCA EXPLOSION, JANUARY 15, 1882:

Caused by a blown-out shot in the main intake, killing four men and 60 horses; *Wilkinson,* 5537–39. Dust raised in the air by two shots and fired by a third shot which had hung fire; no gas whatever; the roadway in a stone drift, and the point where the explosion was initiated was only two or three hundred yards from the bottom of the shaft; 5540–48, 5571–78, 5595–601. The effect of damp places; 5581, 5582.

Does not see how there could have been much dust to explode; *Bedlington,* 5711.

ROBURITE:

Said to be absolutely safe, but there have been accidents with it; *Ashworth,* 4686.

Objected to in South Wales because it is not so effective as powder, and gives off fumes; *Morgan,* 4846–48, 4916–24.

There is a scintillation from roburite, but scarcely a flame; a committee formed in Durham examined into the question of the fumes, and found that although unpleasant they were not injurious; *Forman,* 5093–97. Cannot say that it is absolutely safe in gas; 5098 Used at Hetton; 5099.

A workman in Lancashire is said to have been poisoned by it; *Woods,* 5320–24.

Shows less flame than the other high explosives; *H. W. Martin,* 5444.

SEAHAM EXPLOSION, 1880:

Witness engaged for 12 months in the mine as an explorer; *Forman,* 5053–55. A dust explosion entirely; caused by an ordinary shot—not a blown-out shot—in the stone; 5056–58, 5061, 5069, 5070. The ventilation would prevent any accumulation of gas; 5059, 5060. Precautions are now taken against dust; 5084, 5085. Cannot conceive where gas could have come from; 5153. Never known gas in the rock in Durham, and cannot believe that gas was in the roof; 5153–55.

Describes an explosion at Seaham in 1871, which, he believes, was a dust explosion; *Forman,* 5062, 5063.

SECURITE:

Said to be absolutely safe, but there have been accidents with it; *Ashworth,* 4686.

SHERIFF PIT, SILVERDALE:

The case of a blown-out shot in 1878; *Ashworth,* 4609. Believes that it was due to the absence of ropes, chains, &c. that electrical conditions were not set up to disturb the dust and so prolong the explosion, 4676.

SLADDERHILL EXPLOSION:

See under "APEDALE."

SOMERSET, BRISTOL, AND DEAN FOREST COLLIERIES:

A resolution from a meeting of colliery managers in this district, with respect to Mr. W. N. Atkinson's report on these mines (*see* Appendix XI., First Report). The resolution affirms that the dust in the non-fiery seams of this district will not, *per se,* cause an explosion, and has never been known to cause an explosion. It also contains recommendations with regard to experiments; *Brain,* 5795–800, 5910–22. It is to be noted that this resolution refers only to the *non-fiery* seams; 5904–909.

SOUTH WALES DISTRICT:

These mines are fiery and the majority dusty; *Morgan,* 4814, 4815. To restrict gunpowder in these collieries to the hard ground, and to forbid its use

SOUTH WALES DISTRICT—*continued.*

in the actual coal getting, would be a blow to the industry; 4829, 4830. And would stop about one fourth of the collieries; 4833, 4863. To forbid the use of gunpowder for the actual coal getting would increase the cost of production by something like 6*d*. per ton; 4865, 4866. More powder used than is necessary; 4867–73. The provision of the Mines Act, which enables the workmen to examine the mine from time to time, is taken advantage of in South Wales, but not as a rule. When such examination is made, observation is directed rather to the general ventilation of the mine, &c., than to coal dust; 4928–33.

Knows of no explosion in South Wales within the last 10 years caused by coal dust alone; *Isaac*, 5024.

The thin seams in South Wales are worked by longwall, but there is a great deal of roof ripping and and bottom cutting, which produces shale and stone dust; mixed with this shale and stone dust, the coal dust is less liable to burn or inflame; this partly accounts for the non-liability to explosions of coal dust in Welsh mines; *H. W. Martin*, 5351–54. The quality of the coal dust differs in various mines, and some might be expected to be more inflammable than others; 5355, 5356. Refers to Mr. Galloway's experiments, in which the only dust which would cause an explosion was from the Rhondda Valley; 5355–60, 5479.

For the system of watering adopted by the Dowlais Iron Company's Collieries, *see Mr. Martin's* evidence under "WATERING."

The Plymouth Iron Company's Collieries in the Merthyr Valley adopt the spray system of watering; it is also employed in the collieries of the Powell Deefryn in the Aberdare Valleys; *H. W. Martin*, 5405, 5406. The practice of damping as provided by the Mines Act is pretty generally observed, 5525. A most serious thing if explosives were done away with in South Wales; 5445.

Risca Colliery, Abercarn Colliery, the National Colliery, and North Dunraven Colliery, described as very dry and gaseous; *Wilkinson*, 5535, 5536. Ammonite used with gratifying results; has used many special apparatus in blasting; 5561–65. Several very heavy outbursts of gas in South Wales; 5570. Explosives not used in the actual coal getting, but only in the roof; 5583–90. Impossible to carry on the collieries of South Wales at a profit without using explosives; 5591. Since the explosion at Risca has never fired a shot in that seam, but would not consider it at all dangerous to use ammonite there; 5602–605. To prohibit the use of explosives in the mines under his charge would increase the cost of working by a shilling per ton, or even more; 5623. Describes the use of the long feather wedge; it answers very well, but is not much used on account of the slowness and expense of the process; 5630–43.

Nearly all the deep mines are dry and dusty; *Bedlington*, 5696–98. Does not water the dust; prefers to remove it; water softens the strata in the roads; 5699–5704. Uses a variety of explosives; 5705, 5706. The mines of which he has had experience are deep, dry, dusty, and fiery; 5746–48. Removes the dust in the roads, and wherever safety lamps are used has regard to the watering in the vicinity of the shot and the place where the shot is to be fired; 5749.

The precautions taken with regard to coal dust; shot firing; the use of gelignite; the system of watering and hygrometrical observations in the collieries of the Glamorgan Coal Company; *Hood*, 5948–6039.

The Aberdare and Rhondda Valleys include the largest and driest mines of South Wales; they are fiery mines; *Thomas*, 6193–97. At the Standard Colliery the spray system of watering is employed; 6242–51. Additional precautions are not necessary in the working of the collieries in the Aberdare and Rhondda Valleys as regards dust; 6285.

Watering in South Wales; *J. S. Martin*, 6668–70.

See also under "ABERDARE AND RHONDDA VALLEYS COLLIERY OFFICIALS ASSOCIATION."

SWAITHE MAIN PIT EXPLOSION:

Caused by a safety lamp passing the flame through the gauze in a current of air containing firedamp and suspended coal dust; *Ashworth*, 4604. The explosion carried on by dust; 4605–607. A Stephenson's lamp; 4608.

THOMAS, JOHN JAMES:

Manager of the Standard Colliery in the Rhondda Valley: 6191. Gives evidence on behalf of the Colliery Officials' Association of the Aberdare and Rhondda Valleys; 6192. This association represents an annual output of eight million tons and 45 collieries; 6267–70. The Aberdare and Rhondda Valleys include the largest and driest mines in South Wales; they are also fiery; 6193, 6194.

Has had 28 years' experience; 6195–97.

Believes coal dust to be a danger in carrying on explosions, and that it can carry on an explosion for a considerable distance; 6198–6202.

Is of opinion that coal dust will not explode at a naked light. Refers to coal dust at the tips where there are big fires and torches; 6203–205, 6255–66, 6291.

Believes that the explosion in the hopper at Brancepeth was not due to dust but to gas given off from the dust; 6206–209, 6253–55, 6287–89.

Believes that coal dust, even when so thick in the air that it would almost be impossible to breath (as he has seen it in the roads) will not explode at a naked light; 6210–14.

Under such circumstances the dust might be very dangerous in the presence of a blown-out shot of gunpowder or a low explosive; 6215–17, 6237, 6290.

Coal dust will increase an explosion of fire-damp; 6217, 6218, 6238.

Coal dust raised by falls of roof will not ignite at a naked light; 6219, 6220.

There is a distinct difference between fire-damp and coal dust in a safety lamp; the one explodes, the other only flickers and sparkles. Concludes from this that coal dust will not explode at a naked light; 6221–23.

If the coal dust is mixed with fire-damp, it makes very little difference inside the lamp; 6224.

Believes that coal dust mixed with fire-damp is more explosive than coal dust alone; 6225.

Has made experiments which show that gunpowder, or low explosives, will ignite the dust, and that the flameless explosives will not do so in any case; 6226–32.

In these experiments has tested ammonite, bellite, and ardeer powder. Each showed a little flame, not, however, of sufficient duration to ignite the dust; 6233–36.

Has never known a high explosive without flame, but they are much safer than gunpowder; 6278–84.

As precautions against the dangers of dust, suggests the use of flameless explosives; 6239. Recommends tamping of the high explosives with a damp and non-combustible material; 6240.

With regard to gas, thinks the provisions of the Mines Regulation Act quite sufficient. Believes that the dangers of coal dust might be removed by the prohibition of the use of explosives of the gunpowder class, and by modifying the condition of the dust by water as required by General Rule 12; 6241, 6285.

Uses the spray system of watering, the water being under pressure. By this means perfect saturation of the air is obtained; 6242–51.

Of all the high explosives, thinks ardeer powder gives the least flash; 6252.

States that he does not believe that any of the members of the Colliery Officials' Association of the Aberdare and Rhondda Valleys are of the opinion that coal dust would ignite from an open light or even from a torch. He believes that they are all in accord that coal dust will explode by means of a blown-out shot, and in the absence of gas; 6269–75.

Thinks that coal dust always gives off a little gas, but more when it is fresh; 6276.

Regards it as desirable to make experiments with the various explosives; 6292–6295.

TONITE:

Used at Hetton Colliery: *Forman*, 5099.

TRIMDON GRANGE EXPLOSION:

Initiated by gas and carried on by dust; *Forman*, 5064–70.

TUDHOE EXPLOSION:

A dust explosion; *Forman*, 5068–70.

USWORTH EXPLOSION:

The course of the explosion described; a dust explosion; *Forman*, 5071–3.

WATER CARTRIDGE:

They are used in South Wales, but witness has had no personal experience with them; *Morgan*, 4836, 4837, 4911–14.

Has tried the water cartridge; *Wilkinson*, 5565. The explosion at the National Colliery was caused by an Abel's envelope used without the water; 5568, 5569; *J. S. Martin*, 6655.

WATERING AS A PRECAUTION:

Watering no value whatever; impossible to prevent an explosion by watering the place before shot firing as the dust does not become saturated; thoroughly wet places in various parts of the mine will arrest an explosion: *Ashworth*, 4643. 4718. A damp space of 70 yards quite long enough for this purpose; probably a good deal less will do; 4644. Morfa Explosion referred to as an illustration; 4713. Believes watering is not of any value; 4715. Where watering has been done, it is as dry as tinder underneath; 4716. Recommends watering as a sanitary measure; it makes the roads pleasanter to travel on; 4717–4719. Suggests that watering may become a source of danger; should an explosion occur, it is possible that the aqueous vapour may serve to increase the effects of it; 4717.

Watering, as practised in South Wales, is effective, and keeps the dust damp; *Morgan*, 4822–25. Water provided in sprays and carried in by the intake air is excellent, and improves the health of men and horses; 4839, 4840. Where done effectually, the use of gunpowder could be continued with little or no risk in South Wales mines; 4841. Watering does not dispense with the necessity for removing the dust to a thin covering; 4842–44, 4897. Attaches more importance to the watering of the dust than to its removal; 4898–900. In South Wales the dust is removed and thoroughly watered; 4901–904.

Watering is a practicable precaution as far as the travelling roads are concerned: impracticable to water the dust in the working faces; *Isaac*, 4942, 4943, 4947. The intake is not sufficiently saturated with moisture to lay the dust in the faces; 4976–79.

Watering should be done, especially in the intakes or any places where there is an accumulation of dust: not possible to water the working faces; *Forman*, 5079–82. A damp district untouched by the explosion at Trimdon Grange and at Usworth; 5066, 5067, 5071. A few yards of dampness sufficient to arrest an explosion; 5116–18.

A safeguard against explosions where it can be done, and makes the mine pleasanter to work in; *Woods*, 5296–99.

Considers that the damping of the dust is the chief means of preventing the extension of explosions; *H. W. Martin*, 5354. Explains the spray system of watering which has been employed at three of the Dowlais Iron Company's Collieries since 1886: compressed air about 45 lbs. per square inch: damps the dust in the intakes and returns: the sprays are placed from 50 to 80 yards apart: probably one in every 200 yards would sufficiently damp the dust: in order to carry the saturation a considerable distance it is desirable that the water, even when it is at high pressure itself, should be accompanied by air at high pressure also: by this system the dust is absolutely damped: the spray incidentally improves the ventilation and temperature of the mine: at the South Tunnel pit about 3,000 yards of piping laid down: with this system believes an explosion of coal dust to be impossible: inexpensive to apply especially where compressed air is already working; *H. W. Martin*, 5375–5410. Witness knows of no objection to the use of the spray: all that is necessary for the purpose of damping the dust could be carried out without doing damage to floor or roof; 5414–16, 5448–70. Watering makes the mines pleasanter to work in, 5425. Only carries the damping to the working faces in one instance: generally confines it to the most dusty parts of the main roads, 5505–11.

Approves of the spray system; *Wilkinson*, 5552, 5553. Regards watering as so important and so necessary to the safety of the mine that he considers it should be automatically maintained; 5554–56, 5609–11. Would prefer to use compressed air if possible; 5557, 5558.

Has an objection to watering as it softens the strata in the roads: prefers to remove the dust instead; *Bedlington*, 5699–5704.

WATERING—*continued*.

In the South Wales mines most of the main roads are watered—in some cases by means of tanks, in others by means of jets; *Hood*, 5953, 5954. Witness prefers the jet system: thinks the system with compressed air the best, but witness gets very nearly the same result by pressure upon the water without introducing the air; 5955–64. Describes the system of watering adopted by the Glamorgan Colliery Company, and produces hygrometrical tables showing the effect upon the atmosphere under various conditions; 5965–87, 6014–17, 6037–39. The only really effective way of damping is by steam, but in practice it cannot be done as it brings down the top and lifts the bottom; 5984, 5985. Watering by the spray removes the danger of coal dust: in witness's opinion an explosion cannot spread along roads that are damp; 5988, 5989. Has had the dust analysed for moisture: the natural moisture in the coal is ·80 per cent.: the moisture in the dust after watering is 1·84 per cent.: does not think dust with this amount of moisture would explode or ignite; 5996. Witness would only apply these watering arrangements to collieries where the natural heat is high in order to lower the temperature to make it more comfortable to work in; 6011. The quality of the dust has something to do with it: does not think such watering arrangements are necessary in the Scottish mines; 6012, 6013.

Uses the spray system with a pressure on the water, without compressed air, and obtains perfect saturation; *Thomas*, 6243–51.

A highly desirable and necessary precaution, but not totally effective; *J. S. Martin*, 6605, 6606. This statement applies to the spray system in use in South Wales; 6643–50. The extent to which watering is practised in the South-western district; 6660, 6668–70.

WEDGE, THE:

Not used extensively in Durham: it answers well but is very hard work and the men prefer roburite as being easier; *Forman*, 5122–29.

Recommended as a substitute for explosives; *Woods*, 5203–12.

Explains that he means any patent wedge; 5315–20.

Grafton Jones' Hydraulic Wedge, Chubb's Wedging Machine, Bidder's Wedge, tried in South Wales; *Wilkinson*; 5565. The wedge not generally applicable: cumbersome, expensive, and liable to get out of order; 5566. Is using the long feather wedges and finds it answer very well: only uses it in the stone: in an ordinary shale roof, a few minutes are sufficient to break the stone down: if hard, it may take two hours: much safer than any flameless explosive, but not much used on account of the expense and slowness of the process; 5630–43.

WEST STANLEY EXPLOSION:

A dust explosion; *Forman*, 5071.

WILKINSON, GEORGE WILLIAM:

General manager of the Risca Colliery and the Abercarn Colliery in Monmouthshire, and the National Colliery and North Dunraven Colliery in the Rhondda Valley, Glamorganshire; 5535.

These mines are very dry, and dusty, and gaseous; 5536.

Gives the details of an explosion at Risca on January 15, 1882, by which four men and 60 horses were killed. Considers that dust was raised in the air by two shots, and fired by a third which had hung fire and blew out. A fiery mine, but the accident occurred in the main intake two or three hundred yards from the bottom of the pit where it was impossible for gas to have been present. Impossible for gas to have been drawn out of the old workings by the firing of the shots; 5537–48, 5571–78, 5595–603.

Believes coal dust to be a very serious danger, and that it may cause an explosion even in the absence of gas; 5549, 5550.

To guard against the danger he thinks it necessary to thoroughly water the ways; in fact, to saturate the atmosphere; 5551, 5607.

Approves of the system of watering with a spray under a pressure of compressed air; 5552, 5553.

Thinks the saturation of the atmosphere is so absolutely necessary to the safety of the mine, that he

WILKINSON, GEORGE WILLIAM—*continued.*
recommends that it might be automatically maintained; 5554–5556, 5609–11.
Prefers the compressed air system of damping; 5557, 5558.
Advises the use of explosives as nearly flameless as possible; 5559, 5560.
Has been using ammonite for the last two or three years, and has never had any complaints from any of the shot-firers of their having seen any sparks or flames, and has had no complaints of the fumes; 5561, 5562, 5585, 5604, 5612–22.
Does not think powder is necessary in any mine. Ammonite does its work well; 5563, 5564.
Has tried the Grafton Jones' hydraulic wedge; Chubb's wedging machine; the compressed cartridge used in Staffordshire, the lime cartridge, and Sir Frederick Abel's water cartridge; 5565.
The wedges are not applicable for several reasons; 5566. Safer than the most flameless explosive, but expensive and slow; 5629–43.
If a flameless explosive, like ammonite, were used in shot firing, and the air of the mine kept saturated, thinks there would be practically no danger from coal dust; 5567, 5625–28.
Refers to an explosion at the National Colliery in which dust, he considers, played a part, and which was caused by the careless use of an Abel envelope; 5568–70, 5583, 5584.
The explosions both at Risca and the National Colliery did not pass damp places; 5579–82.
Has had several blown-out shots with ammonite; 5586–89.
Uses no explosives in the actual coal getting; 5590, 5634–36.
Impossible to carry on the collieries of South Wales without explosives; 5591.
To abolish explosives in the mines under his superintendence would increase the cost of working by about a shilling a ton; 5623, 5624.
Does not think that the duty of reporting accumulations of coal dust could be put in the hands of any fireman or any individual; 5592–94.
Believes further experiments are very necessary; 5644–53. They should be made in a long gallery on the surface, and it should be the width of an ordinary heading in a mine; 5644–53.
Small experiments would not be convincing; 5654–57.

WOODS, SAMUEL:
President of the Lancashire Miners' Federation, which has a membership of 42,000; 5176, 5177.
Vice-President of the Miners' Federation of Great Britain, with a membership of about 178,000; 5178, 5179.
Worked for about 22 years in the Lancashire mines; 5180–83.
Believes that "coal dust may act as an auxiliary or an intensifier upon an originated explosion"; 5184.
Coal dust cannot initiate an explosion; 5185, 5292.
Has been in the most dusty mines imaginable, where gunpowder was used *ad libitum*, and yet never saw the slightest trace of danger of an explosion arising from dust; 5186.
No analogy between the experiments of Mr. Hall, and others, and the conditions of a coal mine; 5187, 5188.
In Lancashire the fiercest explosions have been in the mines which were the best ventilated; 5190.
In these cases, he attributes the explosions entirely to gas, and believes that the gas in the Lancashire 9-feet seams is entirely different from that in most mines—that it travels with the ventilation and is not so easily perceived; 5191, 5192, 5252–62.
When an explosion is caused, coal dust may extend it for a short distance; 5193, 5293–95.
Describes an accident in Laffak Garswood mine. The place was completely enveloped with dust, but yet there was not the slightest trace of the dust being ignited by the flame which was produced; 5194, 5263–84.

WOODS, SAMUEL—*continued.*
Has never seen the slightest trace of caked or burned dust after an explosion, and is rather suspicious about statements of its existence; 5195–5200, 5247–51.
Believes that all explosions are due to gas, and that dust only plays any part in very exceptional circumstances; 5201, 5202.
Believes that shot-firing—whether by gunpowder, roburite, tonite, dynamite, or any of the patent explosives—ought to be abolished; 5203.
Does not know of anything else that could be employed in the place of shot-firing, except the wedge; 5204, 5205, 5315, 5316.
The wedge could be used universally in coal mines. Thinks coal, as hard as any seams in the country, is being got in Lancashire without any kind of explosives; 5206.
To abolish shot-firing would, of course, increase the cost of mining, but the increase, he thinks, would be very little; 5207–211.
At a miner's conference in 1887, believes that the whole of the representatives, with the exception of those from South Wales, were agreed to advise the Government to abolish shot-firing altogether; 5212–14.
Speaks from experience in his own district, and only speaks with reference to South Wales from imported knowledge; 5215.
Qualifies his suggestion on the prohibition of shot-firing. In rock, or for driving through hard measures between seam and seam, &c., there might be exceptional treatment. Thinks that some of the patent explosives, if under proper supervision, and at proper time, might be used with perfect safety: 5216–20, 5240.
There might be greater freedom with regard to powder in open light collieries, but is convinced that no mine is safe from an irruption of gas; 5225–30.
Would limit the prohibition of gunpowder to collieries where there was a liability to irruption of gas: 5225–30.
In the Lancashire mines the coal can be got without explosives. They simply have the coal to deal with, and do not interfere with the rock floor and roof; 5231–38.
Has nothing to suggest with regard to what is the common practice in all coal fields now with respect to setting off shots when there are not many men in the pit; 5241.
So long as there is shot-firing in dangerous seams there is always a liability ~~to~~ explosions, and suggests that, if shot-firing is allowed, the Mines Act should be literally carried out; that there should be an adequate amount of ventilation, and that the managers should see that the safety clauses are carried out with a view of preventing accidents; 5243.
Believes there are exceptional cases where the Mines Act is not carried out; 5244, 5300.
Thinks the Act is fairly carried out, but is of opinion that there is not sufficient inspection; 5245, 5246.
Watering is a safeguard against explosions and makes the mine pleasanter to work in; 5296–99.
If the First General Rule with regard to ventilation is rigidly carried out, and sufficient precautions are taken with regard to the shot-firing clauses and watering, he does not see what other remedy could be suggested; 5302–305.
Falls of roof and naked lights; 5306–308.
To prohibit shot-firing would come very heavy on the collieries working hard seams; 5309, 5310.
Believes Seaham explosion was due to gas: 5311–14.
Refers to the case of a Lancashire collier who is said to have been poisoned by the fumes from roburite; 5320–324.
The high explosives are safer than gunpowder but not so effective; 5325.
Believes that 90 per cent. of the workmen belonging to the association of which he is vice-president hold the opinion that dust cannot originate an explosion; 5326–28.

Res.
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